SCIENCE ABSTRACTS.

Section A.—PHYSICS.

JANUARY 1905.

GENERAL PHYSICS.

1. *Volumenometer for Considerable Range of Temperature.* **L. Zehnder.** (Ann. d. Physik, 15. 2. pp. 328–343, Oct., 1904.)—In an earlier paper the author described a volumenometer in which only small quantities of the substance whose density is required need be used [see Abstract No. 1301 (1903)]. In the present paper a modification of the instrument is described, with which it is possible to determine the volume of the substance at any temperature within the range for which mercury is liquid. The principle of the determination is almost exactly the same as in the previous case, but a detailed account of the method of raising the substance and its containing vessel to the required temperature before introducing it into the barometer tube is given. The method of experimenting is very fully described, and the author gives several determinations in the case of mercury and sulphur. A volume of 0·18 c.cm. of ordinary stick sulphur broken into small pieces gave a density varying from 2·087 to 2·10 at 21·4° C. This result is 1 per cent. higher than that for natural rhombic sulphur according to Deville. The volume used was very small, and the author attributes the error to air and moisture in the cracks and pores, which diffuse out into the vacuum. With 0·19 c.cm. of monoclinic sulphur at 24° C. the agreement is slightly better. The density is found to be 1·915. S. G. S.

2. *Method of Determining the Friction in Tubes for very Small Velocities.* **C. Forch.** (Phys. Zeitschr. 5. pp. 601–602, Oct. 1, 1904.)—The levels of water in two glass dishes are equalised by means of a glass siphon: water to a slight height is then added to one of the dishes, and the amount that flows over in a given time through the siphon is determined by the balance. For speeds of from 80 to 157 (10^{-8} cm./sec.) the coefficient of friction at 18° C. of water in glass (experimentally found) varied from 118 to 122 (10^{-7} gm. weight sec./cm.^{2}). R. E. B.

3. *Stationary Waves in a Gaseous Jet.* **L. Prandtl.** (Phys. Zeitschr. 5. pp. 599–601, Oct. 1, 1904.)—Assuming that there is a velocity potential in a jet of circular section of the form $Vz + af(r)\sin\beta z$, where r and z give the distances from and down the axis of the jet, the author deduces the approxi-

mate equation $f''(r) + r^{-1}f'(r) + (V^2/c^2 - 1)\beta^2 f(r) = 0$, where c is the speed of sound in the gas in its actual condition. The solution of this equation is expressible by Bessel's functions, but is real only if the mean speed of flow V exceeds the speed of sound c in the flowing gas; in this case the greatest wave-length of the stationary waves formed in the jet is—

$$\lambda = 1{\cdot}307\, d\sqrt{(V^2/c^2 - 1)},$$

where d is the mean diam. of the jet. For comparison with experiment the values of $\lambda/\sqrt{(p/p_1 - 1{\cdot}9)}$ are calculated for different values of the pressures on either side of the nozzle, and are found to vary but slightly from 1·2 for values of p from 2 to 12 kg./cm.^{2} with atmospheric pressure for p_1. Emden's experimentally found value is 0·89, and the difference may be due to his nozzles being conical. R. E. B.

4. *Diffusion of Helium through Silica.* **A. Jaquerod** and **F. L. Perrot.** (Comptes Rendus, 139. pp. 789–790, Nov. 14, 1904. Extract.)—In seeking to determine the fusing-point of gold by means of a helium thermometer it was found that the gas rapidly diffused through the quartz vessel. This was appreciable even at a temperature of 220°. For high temperatures nitrogen thermometers will still be the only usable gas standards. R. S. W.

5. *Kinetic Method of Measuring Modulus of Elasticity of Rocks.* **S. Kusakabe.** (Mathematical and Physical Soc., Tokyo, 2. 15. pp. 197–206, 1904.)—The method is similar to that in Melde's experiment. The piece of rock corresponds to the tuning fork, and by its vibrations (produced by an electromagnetically driven tapper) acts upon a thin copper wire stretched by a weight. The frequency of the natural vibrations of the stone is thus found, and hence the modulus of elasticity. This is found to differ considerably from the static modulus, and explanation is found in the alteration of state produced by the rapid vibrations. [See also Abstract No. 2467 (1904).] J. W. P.

6. *Limits of Economy of Material in Frame-Structures.* **A. G. M. Michell.** (Phil. Mag. 8. pp. 589–597, Nov., 1904.)—A theoretical discussion starting from Maxwell's equation, $\Sigma l_p f_p - \Sigma l_q f_q = C$, where f_p is the tension in any tie bar of length l_p, f_q the thrust in any strut of length l_q, and C is a function of the applied forces and the co-ordinates of their points of application, but is independent of the form of the frame. Lower limits may thus in certain cases be found for the quantity of material necessary to sustain given forces. Various simple minimum frames are considered. J. W. P.

7. *The Earth's Motion and Æther.* **F. Biske.** (Ann. d. Physik, 14. 5. pp. 1004–1007, Aug. 23, 1904. From Astronom. Nachrichten, 165. p. 299, 1904.)—A ray of light entering the earth's atmosphere would, had the earth no rotation, strike the earth's surface at a certain angle. The earth having rotation, and assuming the æther to partake of the motion of the atmosphere, the ray will strike the earth's surface at a different angle, so that the star from which the light proceeds will appear to have right ascension increased by the angle through which the earth has turned during the passage of the ray through its atmosphere. In this paper are considered two cases, according as the æther is supposed to partake wholly or only in part of the motion of

the atmosphere. The following formulæ are used: If the angular velocity of the atmosphere be w, that of the æther is $w(\mu^2-1)/\mu^2$, μ being the refractive index of the atmosphere. The relation between the refractive index μ and the density ρ is $\mu^2-1=c\rho$, where c is a constant. From the theory of refraction (Poincaré, Theorie Mathematique de la Lumiere, Fresnel's formula), $d\zeta'=\frac{c\mu_0}{2l_0\mu^3}\left(\frac{a}{r}\right)^3\sin z\rho\frac{dr}{\cos i}$, in which μ_0, a, z at the earth's surface have the same meanings as μ, r, i at the stratum of the atmosphere considered. From these formulæ the writer calculates the effect of the earth's rotation for the two cases, namely, when the æther partakes (1) partially, (2) wholly, of the motion of the atmosphere. He draws the conclusion that the hypothesis of the æther being completely carried with the atmosphere gives too small a value for the apparent increase in right ascension, and is therefore an improbable hypothesis. S. H. B.

8. *Attempts at Methodical Weather Forecasting.* **L. Besson.** (Monthly Weather Rev. 32. pp. 311–313; Note by **E. B. Garriott,** pp. 313–314, July, 1904. Translation from Annuaire de la Société Météorologique de France, pp. 92–97, April, 1904.)—The author regrets that with the advance of scientific forecasting, based upon daily synoptic charts, local forecasting seems to become neglected. Examining twenty-one years' records from Montsouris of the barometer, its variations between 6 and 9 a.m., wind direction and velocity, temperature and cloudiness, for the months December, January, February, the author finds that wind and snow may be predicted with a correctness of about 70 per cent., and that wind direction, which alone gives 67 per cent. of correct forecasts, is the best criterion; then follow in order barometric pressure, wind velocity, temperature, pressure variation, cloudiness. Combination of several of the interdependent elements may diminish the probability. A few characteristic cases are pointed out. Garriott remarks that a meteorological service enlarges the area of vision. H. B.

9. *Annual and Geographical Distribution of Cyclones of High Velocity in the United States,* 1898–1902. **S. Hanzlik.** (Monthly Weather Rev. 32. pp. 358–363, Aug., 1904. Preliminary Report.)—The author is investigating the influence of areas of high pressure (highs), and especially of the St. Lawrence high, on the velocity and direction of movements of areas of low pressure (lows), making use of the records of cyclones, of velocities of over 500 miles in 12 hours, for the period 1898–1902. He distinguishes the northern circuit, the main path of circulation of cyclones passing from the British Northwest directly east across the Great Lakes to Newfoundland, and the southern circuit of cyclones, passing from the Rocky Mountains south-east through Texas, and then east and north-east *viâ* the Gulf States and the Carolinas to the Banks of Newfoundland. No relation between the barometric gradient and the cyclone velocity could be made out for the western portion of the southern circuit. As regards the eastern portion of this circuit, the St. Lawrence highs exercise a deflecting and splitting effect, particularly in February and March, but hardly noticeable in January. The main problems remain unanswered. H. B.

10. *Annual Variation of the Height of Sea Level and of the Barometer.* **F. Omori.** (Mathematical and Physical Soc., Tokyo, 2. 13. pp. 160–163, 1904.)—Determinations of the sea-level have been made at Ayukawa and Misaki,

both situated on the Pacific Coast, and the former near the origins of submarine earthquakes. The author considers that the means of the sea-level heights at the two stations give a curve which is the inverse of the barometer curve. While, however, the mean monthly barometric variation is 9·3 mm., the sea-level fluctuations are not 9·3 × 13·6 = 126 mm., but 276 mm. at Misaki and 219 mm. at Ayukawa, and therefore nearly double the fluctuations of the atmospheric pressure. The sea bottom would appear to be subjected to a greater total pressure in summer than in February to April, owing to there being in summer low air pressure over Japan, but high pressure near the Aleutian islands, so that the water surface should be raised along the Japanese coasts. The pressure would affect the earthquake frequency. [See Abstract No. 2141 (1904).] H. B.

11. *Seismic Triangulation in Tokyo, and Transit Velocity.* **A. Imamura.** (Mathematical and Physical Soc., Tokyo, 2. 13. pp. 151–153, 1904.)—Applying the formula $1/v = 1/V - t/d$, where v and V are the transit velocities of the initial waves of the preliminary tremor and of the principal portion, t the duration of the preliminary tremor, and d the epicentral distance, to eight earthquakes, the author deduces values for v lying between 3·5 and 6·0 km./sec., and for the three phases of V values of 3·0, 2·3, 1·8 km. These waves may travel on different strata. H. B.

12. *Transit Velocity of Earthquake Motion originating at Near Distance.* **A. Imamura.** (Mathematical and Physical Soc., Tokyo, 2. 13. pp. 154–159, 1904.)—Examining records of twelve earthquakes obtained at Tokyo and at Osaka with Omori horizontal pendulum seismographs, with the aid of the formula: velocity $= (d' - d)/(t' - t)$, where d and d' are the arcual epicentral distances of the two stations, and t and t' the times of arrival of the phases at the two stations, the author deduces for the two phases of the preliminary tremor and the principal portion the mean values $V_1 = 13·0$ (from 12 to 16), $V_2 = 7·4$, $V_3 = 4·3$ km./sec. The further formula $d/(t - t_0)$, where t_0 indicates the time of commencement at the epicentre, gives $V_1 = 7·5$ (8·2), $V_2 = 5·5$ (5·8), $V_3 = 3·8$ (3·9) km./sec.; the first figures refer to Tokyo, those in brackets to Osaka. The values for V_1 differ thus considerably. The author assumes that stations near the epicentre—supposing the origin to be at moderate depth—mark directly-propagated waves, while the further stations receive the first records from reflected waves which afterwards travel through the stratum of quickest propagation. An appendix examines records from Mizusawa in the same way. H. B.

13. *Seismological Notes.* **F. Omori.** (Mathematical and Physical Soc., Tokyo, 2. 15. pp. 193–196, 1904.)—Nine large earthquakes of Japan and Europe, the Caracas earthquake of October 29, 1900, and Imamura's pendulum observations, give for the first two preliminary tremors, and the first, third, fourth, fifth, and sixth phases of the principal portion the following average velocities, calculated along arcual paths: $v_1 = 13·6$; $v_2 = 7·2$; $v_3 = 4·6$; $v_5 = 3·3$; $v_6 = 2·8$; $v_7 = 2·4$; $v_8 = 2·1$ km./sec. These values are approximately in the ratios $1 : \frac{1}{2} : \frac{1}{3} : \frac{1}{4} : \frac{1}{5} : \frac{1}{6} : \frac{1}{7}$. The E.-W. component of a Japanese earthquake of June 7, 1904, shows, in the very beginning of the seismogram, a slow vibration (period 6·6 sec.) which has also been observed in earthquakes which are not quite local. It would thus appear that the smallest and quick-period vibrations do not necessarily possess the highest

velocity of propagation; the very first vibration is probably similar to a pulsatory oscillation. Attention is further drawn to the striking similarity in the seismograms, obtained at Hongo, of the two Guatemala earthquakes of April and September, 1902. H. B.

14. *Difference of Longitude: Greenwich—Paris.* **Loewy.** (Comptes Rendus, 139. pp. 1010–1015, Dec. 12, 1904.)—The results of the last determination of this important quantity, which was carried out in 1902, are briefly described. Initiated by the Bureau des Longitudes, in accordance with views expressed by the International Geodetic Association, the scheme was carried out under special provisions by the two Governments. Previous determinations in 1888 and 1892 being suspected of certain systematic errors, every effort was made to eliminate such discrepancies in the present measures, and two entire series of operations were arranged. Both parties were supplied with instruments of exactly similar nature, of the English pattern. In such determinations for stations of high latitude peculiar difficulties occur, and the instrumental corrections and errors must be known with the greatest precision. The axis level error was found by two methods—with the level and by reflection from mercury. Collimation was specially observed by three methods, and azimuth was corrected by using preconsidered stars culminating at suitable times. Difficulties produced by personal equation were eliminated as far as possible by exchanges of observers at the two stations. The programme was conducted by the French and English parties simultaneously, but quite independently, thus giving duplicate values, and the whole series was performed first in the spring, and again in autumn. Considerable delay was caused by the illness of one of the observers, necessitating the re-starting of the observations. The values of the longitude are tabulated for each night of observation, and the resulting corrected value of the French determinations of the difference of longitude between Cassini's meridian and that of the transit circle of Greenwich = 9m. 20·974s. ± 0·0008s. The English value found was 9m. 20·94s., and the extremely small difference between the two determinations may be ascribed to the uncertainty of the probable errors. C. P. B.

15. *Direct and Photographic Observations of Auroræ.* **J. Sykora.** (Acad. Sci. St. Petersburg, Mém. 14. 5. pp. 1–49, 1903.)—The author was a member of the Russo-Swedish Expedition which went to Hornsund, Spitzbergen, in winter 1899–1900, under A. Beyer. Their station was on the shores of Goes Bay, at the foot of Mount Tschebychef, 900 m. in height, and there were several other mountains and also glaciers near by. As the auroræ seemed to play behind and above these mountains, mostly in the east and south-west, the author considers them of local origin. He distinguishes nine kinds of auroræ, arcs, bands, and rays being the most common. Sharply defined edges appeared red or pink, indistinct borders green. He observed more than 1,100 auroræ on the 103 days from September 17, 1899, to March 27, 1900; the auroræ were most frequent and intense between November 29 and December 3, when he counted over 200. As a rule the light was in constant motion; quiet displays were photographed, and twenty-three of the seventy photographs obtained by the author are reproduced. They were taken with a camera which could be turned in two directions, mostly on Warnerke plates; the spectrum photographs [see Abstract No. 777 (1903)] were taken on orthochromatic plates. The paper is essentially a catalogue of short notes and sketches of the 1,100 auroræ. H. B.

16. *Apparent Distribution of the Nebulæ.* **C. Easton.** (Konink. Akad. Wetensch. Amsterdam, Versl. 13. pp. 181–199, July 18, 1904. Proc. pp. 117–134, Aug. 26, 1904.)—The author considers the importance of obtaining a visual survey of the distribution of nebulæ, distinct from that resulting from photographic determinations, such as that instituted by Max Wolf at Heidelberg. It is not to be implied that the two methods of estimation will necessarily give divergent results, but the visual observations show certain peculiarities which need investigation. The nebulæ appear to follow the exact opposite law to the stars, as the nebulæ proper are least numerous in the Milky Way, and increase in number as we go from it in either direction. Reviewing the work of Abbe and Stratanoff, the author then adversely criticises that of the latter, and provisionally adopts the view that the great mass of the nebulæ belong to our stellar system, and that they are *asymmetrically* scattered on either side of the chief plane. Considering then the distribution of the nebulæ with respect to the galactic system, they are compared with other bodies in that system. The *green* nebulæ, having a spectrum formed of lines, sometimes round and well defined as planetary, but often extending over immense regions, are usually found in or very near the galactic zone. Outside the zone are found the *white* nebulæ with a continuous or mixed spectrum ; these are generally isolated, of a spiral form as a rule, and most likely more condensed than those of the other kind. It seems not unlikely that this peculiarity is of somewhat similar nature to the distribution of stars of various spectral types and degree of condensation. Stratanoff's maps of nebulæ have been reduced afresh, and tables are given showing the present author's idea of their distribution, with figures showing the resulting plan of the galactic system. C. P. B.

17. *Spectrum of Nova Persei.* **L. Becker.** (Roy. Soc. Edinburgh, Trans. 41. 10. pp. 251–290, Sept. 9, 1904.)—Spectra of the new star in Perseus were obtained at the Glasgow Observatory from 1901, March 8, until 1903, January. A large spectroscope was attached rigidly to the Breadalbane reflector of 51 cm. aperture and 446 cm. focal length, the prism and lenses having a clear aperture of 8 cm., focal length of collimator 74 cm., of camera 149 cm. The star was kept on the slit by means of a secondary telescope focussed on the slit plate, which was polished and used as a mirror. Tables are given showing the variations in the spectrum structure as the star altered in brightness, special details being measured showing the multiple nature of the chief bands. The spectra observed during the spring months are reduced separately from those during and after August, as by that time the Neva was apparently changed into practically a nebular stage. The last visual observation was made on March 3, 1903, when the only line certainly visible was the nebula line, which apparently coincided with the air band at λ5004. At times it was thought that there was some radiation near the position of λ4481, when comparisons were made with the magnesium spark. C. P. B.

18. *Reduction of Stellar Spectra.* **R. H. Curtiss.** (Astrophys. Journ. 20. pp. 149–187, Oct., 1904.)—Recent advances in the spectroscopic equipment of the large observatories which are being employed in the determination of the radial velocities of stars in the line of sight have necessitated more rigid methods of reduction, and much more delicate adjustment of the spectrograph. A short discussion is given of the sources of error, including changes in the photographic film, inequalities of the micrometer screw due to mechanical causes or variations of temperature, errors of setting and unavoid-

able personal equation, mistaken assumptions of wave-lengths of comparison lines or wrong identification of coincidences, errors of the standard Rowland wave-lengths generally adopted. With the object of eliminating these as nearly as possible, a new method of reduction is proposed. The spectrum of a source of light of known velocity, such as the sun, is photographed with the instrument to be used for the stars, and a standard velocity table is made from the resulting measures of these plates. The subsequent measures of the stellar lines are then plotted in relation to these sun measures, the differences then corresponding to the relative velocity towards the earth of the star and sun. Tables actually used in this way for the measurement of the velocity of W Sagittarii are given as examples, showing that the variation of the radial velocity can be satisfactorily recognised. A list of the velocities shown on thirty-three plates is included, and the results plotted as curves for determination of the orbit. C. P. B.

19. *Physical Nature of the Solar Corona.* **S. Arrhenius.** (Astrophys. Journ. 20. pp. 224–231, Oct., 1904. Lick Observatory Bulletin, No. 58.)—Referring to the suggestion of Langley and Abbot that the principal source of the radiations of the corona is of the nature of an electrical discharge, the author gives his reasons for considering that the brightness and low heat effect of the corona are just such as we should expect from dust particles heated by the radiation from the photosphere of the sun. He calculates the proportion of the angular space of the corona which is actually occupied by coronal particles, working by two methods involving the total light emitted and the heat emitted respectively, taking the measurements of Langley and Abbot as starting points. By both methods the resulting density distribution comes almost the same, indicating that the coronal matter occupies only 1 : 200,000 of the angle of sight. It is suggested that the particles may be of iron or other element of similar density and melting-point, and on this assumption the total mass of the corona works out at $14{\cdot}7 \times 10^{12}$ grammes. C. P. B.

REFERENCES.

20. *Interpolation Method for Reduction of Clock Rates.* **J. Weeder.** (Konink. Akad. Wetensch. Amsterdam, Versl. 13. pp. 302–322, Oct. 6, 1904. Proc. pp. 241–262, Oct. 20, 1904.)—The present paper is a continuation of the one referred to in Abstract No. 383 (1903), and gives further details of the various sections of the reduction, illustrated by actual data observed in the case of two standard clocks at the Leyden Observatory. C. P. B.

21. *Lateral Vibrations of Bars.* **C. A. B. Garrett.** (Phil. Mag. 8. pp. 581–589, Nov., 1904.)—Rayleigh's theoretical result that the shape of the vibrating bar is the same as if it were pulled aside by a force at a specified point is examined experimentally by a photographic and by a microscope method. Slight deviations are found. A simple theory is given. J. W. P.

22. *Vibrations of Strings.* **W. B. Morton** and **T. B. Vinycomb.** (Phil. Mag. 8. pp. 573–581, Nov., 1904.)—The forms of strings excited by plucking and by resonance are studied by the photographic method of Krigar-Menzel and Raps. The cause of divergence from the ideal forms is examined, and the effect of alteration of size, tension, material, and nature of the supporting structure considered. J. W. P.

23. *Elasticity and Strength.* (Engineering, 78. pp. 473–474, Oct. 7, 1904.)—In this article on elastic limit and fatigue the question is raised as to whether below a certain stress the hysteresis of stress and strain has any cumulative effect on the strain. Some interesting information about chronometer balance springs is given. The maximum stress in the material—tempered steel—is $9\frac{3}{8}$ tons per sq. in., and the range double this amount. The stiffness continues to increase for about a year after starting working, and the spring is then practically perfectly isochronous. After stoppage for cleaning, &c., of other parts, the spring again requires time to attain its steady rate of vibration. F. R.

24. *Electrically Actuated Nickel Steel Pendulum.* **J. Mascart.** (Comptes Rendus, 139. pp. 1026–1028, Dec. 12, 1904.)—The author points out the advantages from the points of view of cost and simplicity of a nickel steel pendulum over a compensated balance escapement. He describes a clock with an electrically actuated pendulum made of an alloy having a positive though exceedingly small coefficient of expansion; the coefficient must be positive for good compensation with German silver. The clock is made by the firm Henry-Lepaute, and is considered very suitable for observatories, as the pendulum can be advanced or retarded by the electrical gear without stopping the pendulum. L. H. W.

25. *Probable Change in Gravity.* **K. R. Koch.** (Ann. d. Physik, 15. 1. pp. 146–156, Sept., 1904. Phys. Instit. d. techn. Hochschule, Stuttgart, June 29, 1904.)—The author determined the periods of three brass pendulums both at Stuttgart and at Karlsruhe in 1900. One of these pendulums remained at Stuttgart and was never touched; of the two others, one was very slightly affected by the transport. In 1904 the experiments were repeated with four pendulums of delta metal, which contains 1 per cent. iron; magnetic influences, it is stated, could not have affected the results. Two of these pendulums were left untouched; of the two which travelled, one suffered a little. The results for Stuttgart are: June, 1900, $g = 980{\cdot}914$ (98) cm.; March, 1904, $g = 980{\cdot}917$ (96) cm. The difference is three or five times as great as the mean probable error. The author hence suggests the probability of a change in gravity, or more exactly in the difference between Stuttgart and Karlsruhe; the change might be connected with the vacillations of the earth axis. Gravity determinations are to be made four times yearly at Stuttgart and at two stations situated respectively 100 km. east and south of Stuttgart. H. B.

26. *Tertiary Rainbow.* **J. Neff Huyette.** (Monthly Weather Rev. 32. pp. 325–326, July, 1904.)—A kind of solar halo and rainbow was observed at Chicago about noon on May 2, 1904. The editor adds some comments to the communication. H. B.

27. *Earthquake Observations and the Exploration of the Interior of the Earth.* **W. Láska.** (Akad. Wiss. Wien, Sitz. Ber. 113. 2a. pp. 739–751, June, 1904.)—According to Wiechert the earth may be regarded as composed of a nucleus of constant density, surrounded by a shell, also of constant density, the thickness of the shell being one-fifth of the earth's radius. Milne concurs, but reduces the shell thickness to one-twentieth of the radius. Examining the earthquakes of Caracas (October, 1900, Omori) and of Ceram (September, 1899, Rudolph) under the assumption that an earthquake ray would be refracted in entering the nucleus from the shell, the author confirms Milne's values for the propagation of earthquake waves. But Milne's assumption is astronomically and geophysically untenable—reasons are not stated—while Wiechert's view would lead to impossible transit velocities. The author therefore argues that the velocity of propagation of earthquakes in the interior of the earth must be a function of the radius, and he gives formulæ for a quadratic function. H. B.

28. *Present Problems of Geophysics.* **G. F. Becker.** (Science, 20. pp. 545–556, Oct. 28, 1904. Address delivered at the International Congress of Arts and Science, at St. Louis, before the Geophysical Section, Sept. 21, 1904.)—The author referred to the nebular theory, density and solidity of the earth, its age, continental outlines and seismology, the physics of magmatic solutions, erosion, magnetic polarity of lavas, &c. The physical investigation of the states of aggregation was most important. He urged organisation of scientific work, and concluded with Emmons' plea for geophysical laboratories which was endorsed by the Geological Congress at Vienna in 1903. H. B.

29. *Perrot's Proof of the Rotation of the Earth.* **L. Maillard.** (Comptes Rendus, 139. pp. 562–565, Oct. 10, 1904.)—Perrot showed in 1859 that when water flows through an aperture in the centre of the bottom of a cylindrical vessel, the water particles do not move in radial lines from the circumference to the centre, but are deflected to the right. Attention has been drawn to this experiment by Brunhes (C.R. 138. pp. 915–917, April 11, 1904), and the experiment has been repeated by the author and A. Kuenzi, succeeding in a first series in 12 out of 21 cases, and, in a second series, in 31 out of 33 cases. Sawdust or little floats of wood indicate the stream-lines. The theory of the experiment was given by Braschmann in 1860, and is confirmed by the author's formulæ. [See also Abstract No. 1600 (1904).] H. B.

30. *Radium and the Temperature of the Earth.* **C. Liebenow.** (Phys. Zeitschr. 5. pp. 625–626, Oct. 15, 1904.)—Himstedt having suggested that radium might account for the internal heat of the earth, the author calculates that, with equal distribution through the mass of the earth, $2\cdot10^{-7}$ gm. of radium would suffice per cub. m. to maintain its temperature. But Elster and Geitel want about 1,000 times as much radium to explain the radio-activity of the soil. The radium might, therefore, be more concentrated near the surface, and in that case the increase in temperature which we observe in borings might also be confined to the surface layers. H. B.

31. *Meteorite from the Cañon Diablo, Arizona.* **H. Moissan.** (Comptes Rendus, 139. pp. 773–780, Nov. 14, 1904. Chem. News, 90. pp. 295–296, Dec. 16, 1904.)—The author received a piece, of 183 kg., of this often-examined meteorite, and dissolved 53 kg. in hydrochloric acid. The interior portions gave: Fe 95·37, Ni 3·945, insoluble 0·260, P 0·144 per cent., Si, S, C traces; in nodules he found Fe about 67, Ni 2, S 22, P 2·3, C 1·96 per cent. The carbon occurs in the amorphous, graphitic, and diamond modifications, the diamonds being surrounded by carbon and near the nodules and in the fissures. Reference is made to Stead, and to le Chatelier and Ziegler's observation that iron sulphide diffuses easily across fissures in iron. H. B.

32. *Metals in the Atmosphere.* **A. Ditte.** (Revue Scientif. 2. pp. 709–717, Dec. 3, 1904. Discourse.)—The dust contained in the atmosphere can be collected by filtering air through cotton wool, bubbling it through water, evaporating rain and snow water, or can be gathered in church steeples, &c. Its particles vary between 0·01 to 0·001 mm. in diam.; silica grains of 0·01 mm. would fall 0·66 m. per sec. At Paris, from 2 to 9 mgm. of dust fall per sq. m. in 24 hours; about a third of it is organic. The chief inorganic constituents are iron, its oxides, and the other metals and minerals occurring in meteors; some iron dust comes also from sands, coal, and metallurgical works. Other minerals are ammonium nitrate and sodium sulphate (easily crystallising in the soil or formed in the air from sulphuric acid, other sulphates, and soda or common salt); sodium chloride itself is rarer; borate, phosphate, and salts of Ca, Mg, Al, &c., are still more so. The author also deals with accidental dust from volcanic ashes, great fires, desert clouds, &c. H. B.

33. *Determining the Velocity of Propagation of Earthquakes.* **G. Lippmann.** (Comptes Rendus, 139. pp. 780–781, Nov. 14, 1904.)—The author suggests to start a chronometer by an electric contact device, consisting of a mercury cup and a wire. If three stations A, B, C are fitted with these instruments, and the commencement is observed at A and B, then the velocity of propagation AV along AB can be deduced, and similarly the velocity AV_1 along AC_1; and if these velocities are marked on AB and AC, then VV_1 will be a wave-front. H. B.

34. *Theory of Encke's Comet.* **O. Backlund.** (Acad. Sci. St. Petersburg, Mém. 16. 3. pp. 1–19, 1904.)—All the available observations made during 1894–1895 are collected and discussed for determinations of residuals for the definitive orbit. C. P. B.

35. *Absorption of Starlight through Comet* 1903 (*c*). **M. Wolf.** (Astron. Nachr. 164. pp. 17–20, 1903. Beibl. Ann. d. Physik, 28. 12. pp. 691–692, 1904.)—A short description of possible photographic evidence of light absorption by cometary matter through which a star was photographed. C. P. B.

36. *Rotation Period of Venus.* **F. Löschardt.** (Akad. Wiss. Wien, Sitz. Ber. 113. 2a. pp. 621–626, May, 1904.)—The author gives a review of various determinations of the rotation period of Venus, with some special reference to the measures at the Lowell Observatory in Arizona [see Abstract No. 41 (1904)]. C. P. B.

37. *Nebulæ in the Vicinity of Nova Persei.* **H. Seeliger.** (Astrophys. Journ. 20. pp. 105–112, Sept., 1904.)—In previous papers the author has put forward the suggestion that the phenomena exhibited by the nebulosities around Nova Persei may be explained by assuming they were originated in the illuminating action of the outburst of the central Nova on surrounding cosmical clouds. In this paper he shows the above explanation to be simpler and involving fewer assumptions than various other suggested theories which have been offered. An important point involved is that the determination of the parallax of the Nova from measures of the changes found on photographs of the nebulosity may be illusory if the reflection theory were correct. C. P. B.

38. *Stellar Velocities in Line of Light.* **W. H. Wright.** (Astrophys. Journ. 20. pp. 140–145, Sept., 1904.)—During the summer of 1903 a party from the Lick Observatory established the observatory of the D. O. Mills Expedition to the Southern Hemisphere on the summit of Cerro San Cristobal, near the city of Santiago de Chile. The instrumental equipment consisted mainly of a reflecting telescope of 94 cm. aperture, mounted as a Cassegrain, and a powerful three-prism spectrograph. Work on the determination of velocities in the line of sight was commenced on September 11, and 308 successful spectrograms were obtained up to June 1, 1904. As a preliminary account a list of several stars is given whose velocity has been found variable, special attention being drawn to that of α Centauri, that star having one of the most accurately known of double-star orbits. C. P. B.

39. *Perseids of August,* 1904. **L. Libert.** (Comptes Rendus, 139. pp. 515–517, Sept. 26, 1904.)—An account is given of observations of the Perseids seen at Havre from August 11–12, 1904. In all 339 meteors were seen, and the trajectories of 93 determined. These are given in tabular form, showing the hourly fall and the chief radiants involved. The position of the Perseid radiant appeared to be rather an area than a point, varying from RA = 46° to 54° and Decl. (+ 56°) to (+ 59°). There also appears to be sufficient evidence for the identification of a new radiant in Pegasus, with a maximum near the middle of July, at RA = 357°, Decl. = + 18°. C. P. B.

40. *Stellar Classification in Relation to Temperature and Chemistry.* **A. Fowler.** (Nature, 70. pp. 611–614, Oct. 20, and pp. 635–637, Oct. 27, 1904.)—The two articles give a review of recent work published by Lockyer on stellar classification, in which the various groups are separated according to their spectra, the chief criteria being the appearance of the enhanced lines of the metals and the gases helium, oxygen, nitrogen. C. P. B.

41. *Rotation of Venus.* **P. Lowell.** (Comptes Rendus, 139. pp. 663–664, Oct. 31, 1904.)—Visual observations made in 1896–97 confirmed the period of 225 days for the rotation of Venus, which was first determined by Schiaparelli. Soon after the instalment of the new photographic spectrograph in 1902 a series of observations were commenced as Venus was leaving superior conjunction, the best plates being taken in February and March, 1903. The spectroscope was designed to rotate about the telescopic axis, and the spectrum of the planet was photographed with the slit oriented in various directions. The spectrum of iron was employed for comparison. All the previous determinations were confirmed, thus indicating that the long period of 225 days is most probably the true one. C. P. B.

42. *Rotation of Mars.* **P. Lowell.** (Comptes Rendus, 139. pp. 664–665, Oct. 31, 1904.)—The first results obtained with the new spectrograph at the Flagstaff Observatory, Arizona, confirmed the 225-day period of the rotation of Venus, and the determination of the rotation of Mars was next undertaken with the object of obtaining additional evidence of the truth of the former observations. On account of the different diameters, &c., of the two planets, the quantity to be measured in the case of Mars would be about half that of Venus. The determined period came to be 25 hours 35 min., the true time being 24 hours 37 min., so that there is little doubt of the accuracy of the measures of either planet. C. P. B.

43. *New Algol Variable*—15°·4905. **E. C. Pickering.** (Astrophys. Journ. 20. pp. 296–299, Nov., 1904. Harvard College Observatory Circular No. 88.)—This new variable was discovered on the examination of plates taken in the region of Sagittarius. Previously thought to be of constant brightness, but as soon as the variation was noticed on one plate others were examined, and it was found fainter than the normal on twenty-five nights. The variation is from magnitudes 9·55 to 11·12. An interesting feature of the change in brightness is the fact that a secondary minimum occurs midway between the primary minima, which may be represented by the formula J.D. 2,410,002·677 + 3·45348 E. It is important in that its light-curve is intermediate between that of Y Cygni and Z Herculis. C. P. B.

44. *Dispersion Bands in Spectra of δ Orionis and Nova Persei.* **W. H. Julius.** (Konink. Akad. Wetensch. Amsterdam, Versl. 13. pp. 359–363, Nov. 9, 1904. Proc. 7. pp. 323–328, Nov. 23, 1904.)—The author suggests that the apparent motions indicated by the changes in wave-length of many of the spectrum lines in δ Orionis and Nova Persei may be really due to the varying density of the stellar atmospheres or envelopes, thereby causing variations in the position and structure of the dispersion bands, which would appear as line displacements when compared with the finer absorption lines. C. P. B.

45. *Leonid Meteors of November*, 1904. **L. Libert.** (Comptes Rendus, 139. pp. 912–914, Nov. 28, 1904.)—Observations were made at Havre on the nights of November 14–15 and 15–16, 1904; 111 meteors were seen, and the trajectories of 42 determined. The chief Leonid radiant was found to be RA = 152°; Decl. = + 25°, but a subsidiary point was indicated in RA = 145°; Decl. = + 25°. Two other centres of meteor-activity were ascertained to be (1) near λ Orionis RA = 82°, Decl. = + 10°; and (2) near ζ Tauri RA = 83°, Decl. = + 30°. C. P. B.

LIGHT.

46. *Photo-Electric Fatigue and Photometry.* **W. Hallwachs.** (Phys. Zeitschr. 5. pp. 489–499, Aug. 15, 1904. Physikal. Inst. d. techn. Hochschule, Dresden, July 28, 1904.)—Observations are made upon the estimates of the values of ultra-violet radiation from arc lamps. The photo-electric fatigue is almost certainly produced by ozone, whilst light radiation under ordinary conditions forms no primary cause of the fatigue. Secondary action of the light comes in, *e.g.*, in the Hg lamp, upon the formation of ozone by light. Also from their relatively weak secondary action, fatigue influences (*e.g.*, water vapour) remain in existence. These deductions are drawn from experiments on the substances Cu, Cu_2O, CuO, Pt, fuchsin solution, and from steel, as well as from carbon arc lamps in air at atmospheric pressure. The practicability of quantitative and more exact and long-continued photo-electric researches furnishes a means of study of slow surface changes.

J. J. S.

47. *Anomalous Dispersion applied to Spectroheliograph Photographs.* **W. H. Julius.** (Konink. Akad. Wetensch. Amsterdam, Versl. 13. pp. 138–145, July 13, 1904. Proc. pp. 140–147, Aug. 26, 1904.)—The sun is hypothetically taken to be a mass of gas in which convection currents, surfaces of discontinuity and vortices are continually forming under the influence of radiation and rotation, so that the constituent elements are being continuously intermingled. The radiation with a continuous spectrum, usually considered as proceeding from the photosphere, is produced by the irregular motion of electrons in the deeper layers, where the density is very great. Surrounding this will be the envelope of absorbing gases, whose density will slowly decrease in the direction from sun to earth ; while at right angles to this the variation in density will be more marked. The solar light will thus reach the earth only after passage along paths of slowly varying density in a lamellar or partly tubular gaseous mass, and it is probable that such conditions are ideal ones for the production of considerable degrees of anomalous dispersion. The varying appearances of the solar structure as photographed with the slit set at various distances from the central core of the "K" line of calcium are explained by Hale and Ellermann as due to the calcium vapour existing at different levels from the photospheric surface in the form of tree-like clouds. The author considers this view erroneous, and states that as the density must rapidly change in passing from the centre of the band to the outer shadings, the changes in refractive index will induce anomalous dispersion, and the resulting dispersion bands will account for all the phenomena observed. C. P. B.

48. *Cadmium Amalgam Lamp made of Quartz.* **O. Lummer** and **E. Gehrcke.** (Zeitschr. Instrumentenk. 24. pp. 296–298, Oct., 1904. Communication from the Physikal.-technische Reichsanstalt.)—The lamp is made of quartz tube and is very similar in shape to the Lummer-Arons mercury lamp. The amalgam consists of 100 gm. of mercury and 14 gm. of cadmium, and is pasty at ordinary temperatures, but on warming it is quite liquid. The

lamp is started and used just as the Cooper-Hewitt mercury lamp. The light emitted contains the following rays:—

	Cd.	Hg.	Hg.	Hg.	Cd.	Cd.	Cd.	Hg.
$\lambda=$	644	579	577	546	509	480	468	436 $\mu\mu$.

E. C. C. B.

49. *Radiation from the Hefner Lamp.* **E. Hertzsprung.** (Phys. Zeitschr. 5. pp. 634–635, Oct. 15, 1904.)—Assuming that the distribution of intensity in the visible portion of the grating spectrum of the Hefner lamp can be expressed by the Wien formula $E=C_1\lambda^{-5}.e^{-\frac{C_2}{\lambda T}}$, then the constant C_2/T will be very suitable for the comparison of different series of measurements. The author compares several values of this constant, and finds considerable difference between them, and considers that a better determination of the value for the Hefner lamp is necessary. E. C. C. B.

50. *New System of Micrometry.* **G. Millochau.** (Comptes Rendus, 139. pp. 590–591, Oct. 17, 1904.)—It is proposed to employ two rectangular pieces of plane-parallel glass plate and mount them upon a common axis at right angles to the optic axis of the telescope objective, and between the objective and the eyepiece. By so turning the plates that they enclose equal and symmetrical angles with the optic axis, two images of a star or similar object will be seen, the distance between which is given by the expression—

$$l=2a\sin\alpha\left(1-\frac{\cos\alpha}{\sqrt{n^2-\sin^2\alpha}}\right),$$

where a is the thickness of the plates, n the index of refraction of the glass, and 2α the angle between the two plates. The values of n and a are determined at the beginning, and therefore, in making any measurement, it is only necessary to observe the angle 2α. The instrument is to be used in exactly the same way as the heliometer. E. C. C. B.

51. *Photomicrographic Apparatus for Ultra-violet Rays.* **A. Köhler.** (Phys. Zeitschr. 5. pp. 666–671; Discussion, pp. 671–673, Oct. 20, 1904. Paper read before the 76 Naturforscherversamml. zu Breslau, Sept. 20, 1904.)—The resolving power of a microscope being doubled by the use of ultra-violet rays, a photomicrographic apparatus in which these rays are employed has been designed by the author and made by Zeiss. The rays from an electric spark between Cd or Mg electrodes are passed through a quartz system of prisms which separates out the waves of length 275$\mu\mu$ (Cd) or 280$\mu\mu$ (Mg). The condenser, the spherical lenses of the objectives, and other optical parts are made of quartz, and the image is viewed in a finder, the rays being focussed on and made visible by a screen of fluorescent glass. For camera work cadmium rays are preferred as being more homogeneous; on the other hand, the more intense ultra-violet of the magnesium is better for subjective observations. The use of ultra-violet has the additional advantage that these rays differentiate certain parts of organic preparations which would otherwise require to be distinguished by means of artificial colouring. Thus the chromatin of the nucleus, the horny cells of the epidermis and plant structures, such as cuticle and cork, are almost opaque or ultra-violet. The fluorescence of many organic structures in ultra-violet also enables a study of these to be made in the apparatus, the eye having to be protected by suitable screens against the injurious action of the rays. In the *discussion*, **Lummer** showed, by a consideration of the quantities on which resolving power depends, that the principle employed was the only one by which further progress could be made. G. E. A.

52. *Relation between Stereoscopic Camera and Stereoscope.* **W. Scheffer.** (Phys. Zeitschr. 5. pp. 663–666; Discussion, p. 666, Oct. 20, 1904. Paper read before the 76 Naturforscherversamml. zu Breslau, Sept. 20, 1904.)—If a picture taken with a stereoscopic camera with objective distance greater than 65 mm. is viewed in a stereoscope of which the lenses have the same focal length as the camera objectives, such picture appears diminished, nearer and distorted in depth. After showing that the perception of depth is proportional to the length of base employed, the following rule is given: In order that a stereoscope may not distort its pictures, the focal length of the camera objectives divided by distance between camera objectives should be equal to the focal length of the stereoscope lenses divided by the pupil distance (65 mm.). Use of the rule gives the advantage that wider objective distances and consequently broader single pictures, can be employed without deviating from the fundamental requirements of ortho-stereoscopy. G. E. A.

53. *Improvements in the Diffraction Process of Colour Photography.* **R. W. Wood.** (Nature, 70. pp. 614–616, Oct. 20, 1904. Paper read before the British Association, at Cambridge.)—The diffraction method consists in preparing, by photographic means, a picture in which the areas which are to appear coloured are represented by diffraction gratings of various spacings. Synthesis of colour is obtained by the overlapping of three gratings of different pitch. These gratings give, separately, the colours red, green and violet; when made to overlap each other they give yellow, blue, purple and white respectively, the colours being brought out when the plate is placed in front of the viewing lens. The secondary spectra produced by the overlapping of the rulings are usually so faint as to give no trouble, and some pictures made by means of a set of gratings ruled by one of the Rowland engines compared favourably with the results obtained in the Kromskop. The diffraction process has also been combined with that of Joly. To accomplish this it was necessary to rule the three sets of lines in bands corresponding to the width of the red, green and blue lines of the Joly screen. Gratings thus made are used in the following way: a positive on glass, made from a Joly negative, is "flowed" with a thin solution of gelatin sensitised with bichromate of potash and allowed to dry. The triple-ruled grating is then pressed with its ruled surface in contact with the film and held before the lens of the viewing apparatus. A ten-second exposure to the light of the arc records the grating lines on the film, and the plate is then dipped into warm water and dried. The trichromatic screen of the Joly process is thus done away with; the pictures, however, require the viewing apparatus, and show the same lines as the Joly pictures. G. E. A.

54. *Stereoscopy without a Stereoscope.* **J. Violle.** (Comptes Rendus, 139. pp. 621–622, Oct. 24, 1904.)—Curious photographs were shown, such as are being exhibited by Ives at St. Louis, in which a large amount of relief is obtained by a simple means. To make the negative, a grid having 100 bars to the inch, is placed in front of the photographic plate in the interior of a

camera obscura furnished with two objectives. The grid or grating is disposed at such a distance that the picture of an object, formed on the plate by one objective, is in the position of the shadows cast by the bars relatively to the light from the other objective, and *vice versa*. The picture is thus made up of two separate systems of images arranged in parallel strips. The positive is viewed through a grid, similar to the first, so placed that each eye sees a separate picture, a frame carrying the positive on glass with the grid mounted a little way in front. G. E. A.

55. *New Micrometer.* **G. Millochau.** (Comptes Rendus, 139. pp. 665–666, Oct. 31, 1904.)—Historical notes are given of various previous instruments of precision embodying the principle of two parallel plates capable of rotation being used to measure small distances. Bougner devised the heliometer which carries his name about 1760. Rochon utilised his double-image prism about 1777. This has since been perfected by Arago and Bigourdan. Helmholtz, in 1854, devised an opthalmometer on this plan, and it was mentioned by Wecker and Landolt in 1886. Poynting invented a micrometer in 1893, based on the use of a plate of glass with plane parallel faces placed before the objective of a cathetometer. The movement of this provided for differential measurements. Chretien, in 1902, devised a comparator composed of a glass with plane parallel faces in front of an objective, and arranged so as to only cover half the field. Two images would be seen, one stationary, the other movable when the plate was turned. C. P. B.

56. *New Acetylene Standard.* **C. Féry.** (Journ. de Physique, 3. pp. 838–842, Nov., 1904.)—If a narrow cylindrical burner is used for acetylene, a flame is obtained which has its brightest part at about one-third of its height from the burner. The intensity with a given burner varies very little with the height of the flame, so that if a screen be employed with a rectangular aperture so arranged that the brightest portion of the flame be observed, a nearly constant illumination will be obtained. An improvement is made by focussing an image of the flame upon the screen and then, by a second lens, rendering the beam parallel. E. C. C. B.

57. *Loss of Light by Diffraction of Light at a Narrow Slit.* **J. H. Moore.** (Astrophys. Journ. 20. pp. 285–291, Nov., 1904.)—Recognising the importance of knowing the proportion of light which a spectrograph will usefully pass compared with that transmitted by the telescope objective, a series of comparative measurements have been made with the New Mills spectrograph fitted to the 36-in. refractor at the Lick Observatory. The loss of light may be reduced by using a long collimator, as then a wider slit can be fitted, and the same purity of spectrum still retained, but there is a practical limit to this on account of the size of the prisms thus rendered necessary. A series of graduated exposures were made with the spectroscope at the focus of the large telescope—the latter pointed at a constant hour-angle from the sun—using different slit widths for each set of exposures. The resulting densities on the photographs were then reduced to exposure times giving the same photographic density. The effect of diminishing slit-width being to increase the diam. of the principal maximum of the diffraction pattern, the loss will vary rapidly as soon as the maximum becomes greater than the collimator aperture. For the slit in question, for which it was assumed that no loss occurred at width 0·004 in., it was found to increase very rapidly at width 0·001 in., and amounted to about 40 per cent. at width 0·0005 in. C. P. B.

58. *Loss of Light in 36-in. Lick Objective.* **J. H. Moore.** (Astrophys. Journ. 20. pp. 292–294, Nov., 1904.)—A series of experiments was undertaken to determine the loss of light by absorption and reflection for rays in the region of λ4500 in the objective of the Lick 36-in. refractor. From the data given for the constants of the component lenses of the objective, the glass appears to be quite similar to that of the large object-glass at Potsdam, and therefore Vogel's values for losses in lenses of varying thicknesses were adopted. This indicated that the loss for the visual region would be about 27 per cent., and for the actinic rays 40 per cent. Photographs were then taken of the spectrum of skylight with the spectroscope first at the focus of the objective, and then exposed direct to the sky, and the resulting values of the light ratio computed, resulting in a value of loss of about 49 per cent. As the objective is always combined with a secondary correcting lens for photographic work, it is estimated that this may cause a loss of some 10 per cent., and if this be deducted from the total loss, that due to the objective alone is 39 per cent., which, it will be seen, agrees very nearly with that given by Vogel's formula for the blue photographic region. C. P. B.

59. *Colour Changes in Gold-Gelatine Preparations.* **F. Kirchner** and **R. Zsigmondy.** (Ann. d. Physik, 15. 3. pp. 573–595, Nov., 1904.)—Red colloidal gold solution consists of water, in which are distributed very small particles of gold, which deflect mainly green light. The red colour is not appreciably altered by changing the refractive index of the medium by the addition of gelatine, albumin, sugar, salt, &c., so long as the mean distance apart of the particles remains approximately constant. Within wide limits, also, the colour is unchanged by dilution or evaporation of the gold solution. Colour change into blue or violet only takes place when the particles approach very near to one another, this being brought about by flocculation in the aqueous liquid or by the drying of pieces of gold-gelatine. The separate gold particles may be of very different sizes. The change of colour from red to blue takes place as soon as the particles unite to form clumps, quite irrespective of whether the particles of the red solution, or the clumps formed, are large or small; the colour change depends, indeed, not on an increase in size of the particles but on the approximation of the separate particles, and the absolute number of particles in one of the clumps or flocks is without influence on the change. T. H. P.

60. *Change of Refractive Index of Amorphous Quartz with Temperature.* **F. F. Martens.** (Deutsch. Phys. Gesell., Verh. 6. 21. pp. 308–311, Nov. 15, 1904. **F. F. Martens** and **F. J. Micheli.** Ibid. pp. 311–314.)—A table and curve giving the variation, with wave-length, of the temperature-change of refractive index of an amorphous quartz prism, the readings extending from 185 $\mu\mu$ to 656 $\mu\mu$, and the method employed being that of Micheli [see Abstract No. 833 (1902)]. The curve is included among those drawn from Micheli's results for calcspar, quartz, fluorspar, and rock salt. The decrease, with temperature, of the refractive index is ascribed to expansion. G. E. A.

61. *Koenig's Method of Colour Photography.* (Nature, 71. p. 83, Nov. 24, 1904.)—The method is of the multiple-film kind, but the colours are produced by direct exposure to light, organic colouring material being employed, which is colourless when reduced, but regains its colour by oxidation, the

latter process being quickened by the action of light. Films impregnated with leuco-compounds produced from dyes of suitable colour are exposed beneath their respective negatives, and the red, yellow, and blue images are obtained. In choosing suitable dyes, collodion was observed to greatly enhance the sensitiveness and to improve the vigour of the image. Nitro-mannite is also useful in this respect. The improvement is traced to the action of nitro-cellulose, leuco-bases in an inert film being useless. The fixing agent is a 10 per cent. solution of monochloracetic acid. A summary of the instructions issued with the photographic material is given. G. E. A.

62. *Influence of Solvents on Rotation of Optically Active Compounds. Optical Activity of Tartrates in Aqueous Solution.* **T. S. Patterson.** (Chem. Soc., Journ. 85. pp. 1116–1152, Aug., 1904.)—Results are given of measurements of the rotations of sodium and potassium tartrates, potassium methyltartrate, potassium ethyltartrate, potassium *n*-propyltartrate, and of methyl, ethyl, and *n*-propyl tartrates in aqueous solutions of various concentrations at temperatures from 10° to 100°. As regards the influence of temperature, sodium and potassium tartrates behave alike ; the extrapolated rotations of the homogeneous substances diminish with rise of temperature, whereas in dilute solution they increase. The three homogeneous esters, however, show a rapidly increasing rotation with rise of temperature, whilst in dilute solution the rotation diminishes almost as rapidly. In several cases maximum rotations occur in certain solutions at definite temperatures, and in one instance (that of potassium tartrate) a maximum is apparent in a concentration-rotation curve. The author discusses these observations in the light of the dissociation hypothesis. Of the three potassium alkyltartrates, the *n*-propyl derivative has the highest, and the methyl compound the lowest, rotation both in the homogeneous condition and in dilute solution. T. H. P.

63. *Rotatory Polarisation in Biaxial Crystals.* **H. Dufet.** (Journ. de Physique, 3. pp. 757–765, Oct., 1904. Communication to the Société franç. de Physique, May 20, 1904.)—MacCullagh's conclusion, that rotatory polarisation should take place in biaxial as well as uniaxial crystals when rays pass along their optic axes, was to some extent verified by the experiments of Beaulard, but Pocklington first gave a general method of observation [see Abstract No. 31 (1902)]. The author verifies and extends Pocklington's observations by measuring the rotation of given rays in crystals of Epsom salt, monosodic phosphate, tartaric acid, and rhamnose. Illustrations are given of the circles and spirals seen in a plate of rhamnose cut normal to the chief axis, and the rotatory dispersion of the substance is measured. Finally the crystalline form of biaxials in which rotation takes place is considered.
G. E. A.

64. *The Passive State in Chromium.* **A. L. Bernoulli.** (Phys. Zeitschr. 5. pp. 632–634, Oct. 15, 1904.)—Active and passive iron have been shown by Micheli to behave differently towards polarised light, and the existence of a relatively thick surface layer on the passive metal has been inferred. [See also Abstract No. 2588 (1904).] Similarly the author has determined, for active and passive chromium, the constants of reflection of monochromatic light plane, polarised at 45° azimuth, measuring also the e.m.f. of chromium-platinum in ammonium nitrate. A surface layer is plainly indicated by the experiments, the order of magnitude of the changes in the optical and

electrical quantities when the metal changes from the active to the passive state being the same as Micheli found for iron. The surface layer on the chromium is considered to consist very probably of the remarkable substance $(Cr_2O_3)_2CrO_3$. G. E. A.

65. *Dispersion Bands in Absorption Spectra.* **W. H. Julius.** (Konink. Akad. Wetensch. Amsterdam, Verslag. 13. pp. 26–32, June 8, 1904. Proc. 7. pp. 134–140, Aug. 26, 1904.)—The author describes as "*dispersion bands*" places of absence of light in the absorption spectrum which are produced by the deviations of certain rays passing through regions of the absorbing vapour which are of heterogeneous density and whose refractive index differs from unity. These bands may overlap the true absorption bands, and means must be found of distinguishing between the two phenomena. The maximum darkness of the band need not be central, but may be located some distance on either side, the intervening space being occupied by a lighter structure, in the centre of which will lie the true narrow absorption line. The author considers these bands may account for many of the peculiarities found in spectra, such as widening, shifting, reversing, and doubling of lines. C. P. B.

66. *Relative Intensities of the Spectra of Mixed Gases.* **E. Waetzmann.** (Ann. d. Physik, 14. 4. pp. 772–790, Aug. 2, 1904. From the Physik. Institut der Universität, Breslau. Inaugural Dissertation.)—Some experimental determinations of the intensities of the lines of the hydrogen spectra in mixtures of this gas with nitrogen. The lines at $\lambda = 6563$ and $\lambda = 4861$ in the first spectrum and $\lambda = 6013$ and $\lambda = 5214$ in the second spectrum were selected, and their intensities measured by means of a Vierordt spectrophotometer. In the mixtures containing a very small quantity of nitrogen the intensity-relations of the hydrogen lines were the same as for the pure gas; thus the intensity at constant pressure is proportional to the strength of current, and with constant current strength it increases with decrease of pressure, but at a rather slower rate than with pure gases. It was also found that the addition of a very small quantity of a second gas caused a considerable decrease in the intensity of the lines of a pure gas, and in the case of hydrogen it is the second spectrum which is the more weakened. In every line spectrum the least refrangible lines are weakened more than those most refrangible. E. C. C. B.

67. *Spectrum of the Mercury Lamp with Quartz Bulb.* **E. Ladenburg.** (Phys. Zeitschr. 5. pp. 525–528, Aug. 15, 1904. Phys. Institut d. techn. Hochschule, Charlottenburg.)—A table of wave-lengths and galvanometer deflections is given for a series of thermopile observations in the spectrum of a mercury lamp in a quartz bulb. The dispersion was effected in the ultraviolet by a quartz prism, and in the visible part of the spectrum by a flint-glass prism, the observations extending from 248·2 to 592·5 $\mu\mu$. The curve drawn shows two series of maxima in both of which the energy increases with wave-length, the maxima being situated at 253, 311, 363, 433, and 546 $\mu\mu$ in the one series, and at 297, 404, and 576 $\mu\mu$ in the other, the latter series being of less intensity. A Rubens thermopile was employed. [See also Abstract No. 1637 (1904).] G. E. A.

68. *Spark Lines Occurring in Arc Spectra.* **H. Crew.** (Astrophys. Journ. 20. pp. 274–284, Nov., 1904. Phys. Rev. 19. p. 301, Oct., 1904. Abstract.

Paper read before the Amer. Physical Soc., Sept. 16, 1904.)—Premising that the spark lines of any element are defined to be those which appear in its spark spectrum without appearing in its arc spectrum, or if found in the arc, appear much weaker than in the spark, the author proceeds to review the differences between the chief characteristics of the two conditions with the following conclusions : (1) The spark lines are in general less sharp than the arc lines. (2) The spark lines are stronger and more numerous in the ultra-violet. (3) The minimum potential difference required to produce a spark (except across distances comparable with a wave-length of light) is about 350 volts, which is approximately ten times that required to maintain an arc. (4) Spark lines are in general accompanied by air lines. Adopting the electron theory most of the arc lines would be expected in the spark; the appearance of spark lines in the arc is, however, more difficult of explanation. The first line of this type recorded was the Mg line at λ4481, and subsequently many others have been noted, among which are the zinc line at λ5894, the red Cd line at λ6438, and the Al line at λ2816. It has been thought that the spark lines were produced mainly by the oscillatory discharge, but their occurrence in arc spectra now makes this view difficult of acceptance. Recent investigations have shown that the spark lines are relatively intensified when the arc is subject to certain conditions, such as surrounding it with an atmosphere of hydrogen, ammonia, or oxygen, submersion under water, diminution of voltage, the latter possibly owing to the electrodes not becoming unduly heated by the current as is the case when high voltages are used. With the object of gaining further insight into the minute variations incident to arc discharges, the author undertook a series of experiments with the intermittent arc, across the poles of which was shunted the circuit of a Duddell high-frequency oscillograph, provided with a falling plate for photographing the wave curve given from the mirror; the frequency of the oscillograph was 10,000 vibrations per sec., and its oil-damping practically perfect. On the time axis the scale employed was uniformly 1/4000 sec. = 1 mm. Reproductions of the curves of e.m.f. obtained from iron arc with and without inductance, magnesium arc with and without air-blast, clearly show that whenever the break is shortened there is an undoubted rise in the extra-e.m.f. at break. It is considered probable that the small rise in e.m.f. thus registered by the oscillograph is only a minor indication of the true value, and the existence or intensification of the special spark lines is attributed to this cause. Reference is made to Stark's distinction between *thermal* and *electrical* temperatures as probably agreeing with the above phenomena, his view being that the *arc* is a region of comparatively high thermal and low electrical temperature, while the *spark* is a seat of comparatively low thermal and high electrical temperature. C. P. B.

69. *Ultra-violet Spark Spectra of Platinum and Chromium.* **W. E. Adeney.** (Roy. Dublin Soc., Proc. 10. 24. pp. 235–249, Sept. 17, 1904.)—The spectra have been photographed with the large Rowland grating of the Royal University of Ireland; platinum by using a very pure sample supplied by Johnson and Matthey, and chromium by sparking a saturated solution of pure potassium chromate between platinum electrodes. Tables are given of the lines measured between the limits λ2229·45 and λ4560·21; in the case of platinum 443, and of chromium 1283 lines being recorded. Comparison wave-lengths of the similar lines given by Kayser are included for reference. [See Abstracts Nos. 296 (1902) and 1407 (1904).] C. P. B.

70. *The Third Group of Bands in the Spectrum of Air.* **H. Deslandres** and **A. Kannapell.** (Comptes Rendus, 139. pp. 584–589, Oct. 17, 1904.)—This group of bands has been examined in a spectroscope of considerable dispersion, and the wave-lengths of the component lines accurately determined. In the band with head at $\lambda = 2370$, there are to be found four series of pairs of lines, eight series altogether which can be expressed by an arithmetical progression of the form $n = A + B(m + n)^2$, where A, B, and n are constants. This formula only expresses the measurements with accuracy up to about the 23rd line in each series; after this deviations begin to appear; in four of the series the intervals between successive lines become too large, and in the remaining four they become too small. E. C. C. B.

71. *Spectra of Sun-spots.* **A. L. Cortie.** (Astrophys. Journ. 20. pp. 253–265, Nov., 1904.)—Lists are given of all the lines observed as affected in the spectra of sun-spots during the period 1883–1901 at Stonyhurst. The spectroscope employed was an automatic twelve-prism instrument by Browning, each prism having a refracting angle of 60°. In the earlier observations this instrument was attached to the 8-in. equatorial, and since 1894 to the 15-in. Perry memorial equatorial. All the wave-lengths have been reduced to Rowland's standard, and between $\lambda\lambda 5884{\cdot}03$ and $6867{\cdot}46$ details of observations of 349 lines are given, full comparisons being stated of the degree of widening of the spot lines, probable origin or elements producing the lines, and normal intensities of the lines. The chief phenomena observed in the spectra of sun-spots are: (1) Regarding the general absorption, a want of uniformity in blackness in various regions, with parts sometimes obscured; (2) as regards the selective absorption, the widening of the lines, the darkening of the lines without widening, displacements of lines, obliteration of lines, extensions of widening across the penumbra of the spot, reversals of lines, thinning of lines or reduction of intensity, hazy fringes to lines, and spot bands. A special table is given to show the relative importance of various elements in the phenomena, these being vanadium, titanium, calcium, sodium, nickel, manganese, iron, oxygen (?), and possibly water vapour. It is stated that there is evidence that the iron lines which are widened, while not displacing in frequency other faint lines, are more affected in periods of minimum than of maximum spots, but it is not admitted that this gives any warranty for deducing a difference of character or solar temperature between maximum and minimum spots. The predominance of vanadium and titanium in sun-spots is important, in view of Fowler's recent identification of the flutings in Secchi's third type of stars as due to titanium or to a compound of the metal, and Lockyer's matching of the intensified lines in the spectrum of Arcturus with those of these same elements. Hale has also shown that many of the lines in stars of the fourth type are coincident with lines observed in the spectra of sun-spots. C. P. B.

72. *Necessity for Establishment of a New System of Standard Wave-lengths.* **A. Perot** and **C. Fabry.** (Journ. de Physique, 3. pp. 842–850, Nov., 1904. Report presented in the name of the French Physical Society to the St. Louis International Electrical Congress.)—In this excellent report the authors discuss fully the question of a system of standard wave-lengths, the whole question having arisen as a result of the discrepancy between interference measurements and Rowland's standards, and also the untrustworthiness of the grating for the coincidence method. They arrive at the following con-

clusions: (1) A new scale of standard wave-lengths must be set up. (2) These standards must be lines in the spectra of terrestrial substances, perfectly defined and easily reproduced. (3) They must be measured by different experimenters in terms of the red cadmium ray. (4) The wave-length of the cadmium red ray shall be provisionally considered as being $\lambda = 6438{\cdot}4722$ tenth-metres in air at 15° C. and 760 mm. pressure. (5) In order that Rowland's measurements may not be wasted, a curve of errors must be constructed for these in terms of the new scale. E. C. C. B.

73. *Regularities in the Structure of the Third Cyanogen Band.* **F. Jungbluth.** (Astrophys. Journ. 20. pp. 237–252, Nov., 1904. Translated from the author's Inaugural Dissertation, Bonn University. Zeitschr. Wiss. Photog. 2. pp. 89–108, 1904.)—An exhaustive study of the third cyanogen band at $\lambda = 3883$, principally with a view of testing Thiele's hypothesis and repeating King's work. Thiele suggested that the lines of a series are to be represented by the equation $\lambda = f\left\{(n + c)^2\right\}$, where n passes through all the values of the whole numbers, and c is a constant [Astrophys. Journ. 6. p. 65, 1897]. According to this λ must have a maximum and minimum value, so that each series must have a head and a tail. King [see Abstract No. 678 (1902)], with very long exposures, showed that such tails are present in the carbon spectrum, and found that simple numerical relations exist between the wave-lengths of the heads and the tails. The author has measured the third cyanogen band in the view of these facts. The wave-lengths of the lines, as measured with a grating against Kayser's normal iron lines, are given in the paper. The following results were obtained: (1) The band consists of double lines, whose components lie close together and sometimes superposed. (2) The maximum intervals between successive lines in the four strongest series form an arithmetical progression. In any one series the intervals between successive lines steadily increase until they reach a maximum, when they begin to decrease. The maximum intervals form an arithmetical progression. (3) King's views of the connection between the tails and heads is confirmed, but it was found that the first head and last tail, the second head and last tail but one are mutually connected. Thiele's hypothesis is in this way strongly supported. E. C. C. B.

74. *Influence of Temperature on Radio-active Substances.* **S. Meyer** and **E. v. Schweidler.** (Akad. Wiss. Wien, Sitz. Ber. 113. 2a. pp. 763–790, June, 1904. From the Institut für theoretische Physik and the II. physik. Institut.)—A condenser is found to discharge more slowly under the action of salts of uranium when the temperature is raised. The activity of the salts is not a simple function of the temperature, but depends rather on the rate at which the latter changes. For thorium and radium the effects are complicated by the emanation. The β-rays are much more strongly affected than the α-rays. R. S. W.

75. *Enhanced Lines of Titanium, Iron, and Chromium in the Fraunhoferic Spectrum.* **J. N. Lockyer** and **F. E. Baxandall.** (Roy. Soc., Proc. 74. pp. 255–267, Nov. 16, 1904.)—Following up previous work which has shown that the enhanced lines of some of the metals are prominent in the spectra of α Cygni and the solar chromosphere [see Abstract No. 973 (1904)], while the greater number of the dark Fraunhofer lines are mainly the equivalents of lines in the arc spectra of their respective metals, it has been found that

many of the *weak* Fraunhofer lines, to which Rowland attached no origin, may be accounted for by the further examination of coincidences. The present paper deals with the lines of titanium, iron, and chromium, the enhanced lines of which have been determined from spark spectra obtained with a large concave Rowland grating. A long list is given of the lines thus recognised, with accompanying remarks in cases of possible doubt or duplicate origin. The importance of this relationship is that if these enhanced lines, which are so characteristic of the group of stars of the type of α Cygni, can be proved to occur in the solar spectrum, their wave-lengths will be at once standardised, and will serve as crucial data for work on stellar spectra. C. P. B.

76. *Origin of Radium*. **H. N. McCoy**. (Ber. Deut. Chem. Gesell. 37. pp. 2641–2656, July 9, 1904. University of Chicago, May, 1904. Chem. News, 90. pp. 187–189, Oct. 14; and pp. 199–201, Oct. 21, 1904.)—The author points out that radio-active substances are generally divided into two classes, the first including uranium, thorium, and radium exhibiting permanent activity, and the second uranium-*x*, thorium-*x*, and radium emanation, and polonium, which have only temporary activity. The loss of activity is usually considered due to change of chemical constitution. He questions the permanence of the activity of the substances of the first class. For the α- and β-radiations being material, and it having been proved by Rutherford and Soddy that the loss of activity of uranium-*x* indicates a monomolecular reaction, some loss must become evident in time. The resultant equilibrium of a series of substances transformable successively into one another at a rate proportional to the mass of the transforming substance is then considered, and the results applied to the case of radium. From these it is shown that any radium-containing mineral over 5,000 years old now contains practically its maximum amount of radium. The frequent occurrence of radium in uranium minerals suggests the possibility of uranium proving to be the mother-substance of radium; but on this hypothesis radium should be present proportional to the uranium content. Twelve different uranium minerals of widely different kinds have been examined with this view, and the results are confirmatory, the average value for radio-activity divided by percentage of uranium being 22·1. The corresponding average value for *pure* uranium compounds is only 3·86, so that the old minerals containing, besides the uranium, the maximum amounts of such transformation products are 5·7 times as active as the new uranium salts. Apparently, therefore, there is a series—

$$\mathrm{U} \rightarrow \mathrm{UX} \rightarrow \mathrm{Ra} \rightarrow \mathrm{RaEm} \rightarrow \mathrm{EmX} \rightarrow \mathrm{He},$$

with the possibility of other intermediate or final products. The transformation rates of the second, fourth, and fifth products are so much greater than that of radium, however, that very little of these will be present in the minerals. Taking the activity of radium as 1½ million times that of uranium, and the activity of radium in uranium minerals being 4·7 times that of the contained uranium, there should be 1 part of radium to 300,000 of uranium in such minerals. This amount agrees well with the experimental results. L. H. W.

77. *Effect of Röntgen Rays on Fluor-Spar*. **A. Winkelmann** and **R. Straubel**. (Ann. d. Physik, 15. 1. pp. 174–178, Sept., 1904.)—Some previous observations [see Wied. Ann. 1896; Physical Soc., Abstract No. 825 (1896)] on

the rays given off by fluor-spar exposed to Röntgen rays, have been only in part confirmed by Radeboldt [see Abstract No. 3200 (1904)], who states that the rays from fluor-spar belong to the visible spectrum, or at any rate are not ultra-violet. New experiments are made by means of a method depending on the use of various glasses respectively transparent and opaque to ultra-violet rays. The result is in agreement with the older experiments, viz., that the rays emitted by fluor-spar obtained from the Oltscherenalp give a continuous spectrum lying for the most part in the ultra-violet (400–240 $\mu\mu$), there being a maximum at 280 $\mu\mu$. G. E. A.

78. *Kathode Luminescence of Crystals.* **A. Pochettino.** (Accad. Lincei, Atti, 13. pp. 301–307, Sept. 18, 1904.)—Maskelyne found that the luminescence excited by kathode rays falling on emerald or calamine or zirkon appears to be polarised, while with many other crystals there is no sign of polarisation. The author has extended Maskelyne's work to a larger number of minerals, viz., phosgenite, scheelite, wulfenite, anatase, zirkon, idocrase (dimetric system); calcite, cabasite (rhombohedral system); apatite, corundum (hexagonal system); cerussite, aragonite, anglesite, witherite (trimetric system); orthose (monoclinic system); glass made anisotropic by mechanical means was also examined. It may be said generally that every mineral capable of becoming luminous under the influence of the kathode rays emits light of a characteristic colour, which for minerals belonging to the same species is independent of the natural colour of the crystal studied. In the case of some bodies (*e.g.*, calcite and apatite) the colour of the kathode luminescence is identical with that of the fluorescence excited in them by ordinary light; in other cases (*e.g.*, phosgenite, idocrase cerussite) it is similar; in others, again, it is totally different. The duration of the luminescence after cessation of the kathodic impact is different for different minerals—it persisted for 30 sec. in the case of calcite. The excitation of the kathode luminescence is not equally easy for different substances; it is especially easy with scheelite, apatite, and anatase. The luminescence is in some instances completely polarised; in others (orthose, anglesite, corundum, cabasite, and calcite) there is no trace of polarisation. The alteration of the position of the crystal face with reference to the exciting kathode rays does not alter the mode of the phenomenon. The orientation of the plane of polarisation is not the same for dimetric and hexagonal crystals; thus, to extinguish the polarised light it is necessary to place the lesser diameter of the analyser (*a*) *parallel* to the principal axis in the case of wulfenite, anatase, idocrase, and apatite; (*b*) *normal* to the axis z for phosgenite, scheelite, zirkon. Isotropy produced artificially in an amorphous body gives a more or less partial polarisation of the kathode luminiscence. D. H. J.

79. *Radio-active Gas from Crude Petroleum.* **E. F. Burton.** (Phil. Mag. 8. pp. 498–508, Oct., 1904. Translated in Phys. Zeitschr. 5. pp. 511–516, Aug. 15, 1904.)—An account is given of some experiments with a highly radioactive gas obtained from crude petroleum, which was obtained from a deep stratum of the rocks underlying Petrola, in Ontario. The radio-active gas contained in the fresh crude petroleum was found to be similar in its rate of decay, and also in the rate of decay of the induced radio-activity which it produces, to the emanation from radium, and to the emanation obtained by a number of experimenters from mercury and from certain waters fresh from the earth. This radio-active gas decays approximately according to an exponential law, falling to half value in 3·125 days. It produces an induced radio-

activity whose rate of decay is such that it falls to a half-value in about 35 min. There are indications of the existence in crude petroleum of slight traces of a radio-active substance more persistent than the radium emanation.
J. J. S.

80. *Radium Rays and Benzene Derivatives.* **H. Kauffmann.** (Ber. Deut. Chem. Gesell. 37. pp. 2946–2948, Sept. 24, 1904. Chem. News, 90. pp. 216–217, Oct. 28, 1904.)—The author applies the radium rays to the study of the power of emission of various substances. By far the greater number of benzene derivatives are excited to luminescence by these rays, many of them so strongly that the luminescence is visible at a distance of 10 cm. from the radium preparation, even after the rays have penetrated a sheet of metal. The luminescence is greatly affected by the presence in the compounds of small quantities of impurities. The greatest power of luminescence is exhibited by benzene derivatives having many rings, and especially by those the vapours of which give a violet luminescence under the influence of the Tesla currents. Benzene derivatives whose vapours do not luminesce in the Tesla experiments are in some cases excited very strongly by the radium rays and in other cases not at all. Coloured benzene derivatives are apparently very little affected by radium rays, this being the case with azobenzene, the nitranilines, diphenylamine, quinoxaline, and *o*-aminocinnamic acid. As the last two compounds fluoresce, it is seen that there is no direct connection between fluorescence and susceptibility to the influence of radium rays. The power of luminescent emission is probably conditioned by the presence of two parallel double-bonds in the nucleus of the molecule. The colour of the emitted light is scarcely recognisable in the case of most substances; in very luminescent colourless substances it is blue to violet. [See also Abstract No. 2553 (1904).]
T. H. P.

81. *Slow Transformation Products of Radium.* **E. Rutherford.** (Phil. Mag. 8. pp. 636–650, Nov., 1904. Communicated to the St. Louis International Electrical Congress, Sept. 16, 1904.)—It has already been shown that the radium emanation gives rise to three products, radium A, radium B, and radium C, having their own rates of decay of activity. The Curies have shown that there is always a residual activity, of the order 1/20,000 of the initial activity, on any body which has been exposed to the emanation. It is now shown that this is due to two distinct products, radium D and radium E. Various metals were exposed to the emanation for seven days, and after a further interval of two days their activity was tested. Different metals gave different saturation currents at first; the activity of each sank to a minimum value and then gradually rose; after a month's interval the values were three times the minimum value. The initial differences between the plates also disappeared with the time. The residual activity comprised both α and β rays, the latter in a very unusual proportion. The equality of the activity and the identity of the radiation from each plate show that it must be ascribed to changes in some form of matter deposited on the plates. The active matter can be removed from a platinum plate by the action of sulphuric acid. Exposure of the plate to a temperature of 1,000° removes the α-ray activity, but is without effect on the β-rays. The α-ray portion can be removed from the sulphuric acid solution by putting into the latter sheets of bismuth. It is found that the α-ray activity increases with the time if the β-ray product is present. It is therefore concluded that the latter gives rise to the former, and the names radium D and radium E are proposed for them. The rates of

decay of these products are very slow, so that they have not yet been measured directly. It is shown that a rough estimate can be formed of the time required by each to reach its half-value. These times are for radium D about 40 years, for radium E about 1 year. These values are supported by the amounts of each product found in a sample of old radium in the author's possession. Weight for weight radium D emits 25 times as many β-rays per sec. as does radium; radium E emits 1,000 times as many α-ray particles as radium which has been freshly prepared. Finally, substantial reasons are given for the supposition that radium E is the substance separated by Marckwald, and called by him radio-tellurium, while it may also be identified eventually with the polonium of Mme. Curie. R. S. W.

82. *Emanium.* **F. Giesel.** (Ber. Deut. Chem. Gesell. 37. pp. 3963–3966, Nov. 12, 1904. Chem. News, 90. pp. 259–260, Nov. 25, 1904.)—In reiterating the differences noted in the behaviours of the author's own preparation (emanium) and the actinium of Debierne, it is pointed out that the induced activity caused by emanium falls to ½ in 34·4 min. (Elster and Geitel) as compared with 40 min. for actinium (Debierne). Also that the three lines of the phosphorescence light of emanium determined by Hartmann [see Abstract No. 3192 (1904)] have not been found in actinium preparations. He therefore retains the name of emanium until further proof is given of the identity of the two substances. The behaviour of an impure strontium chloride containing emanium, which emitted strong β-radiation and emanation, is referred to. This, when dissolved in water and filtered until clear, gave a luminescent solution which still emitted the β-radiation, diminished only in proportion to the dilution. Barium chloride, however, loses its β-radiation in solution. A note is added on the behaviour of the radium emanation. The gas occluded by about 0·25 gm. of radium-barium bromide crystals was driven off, with the emanation, by heating in carbon dioxide, collected over water and washed with carbonic acid. After absorption by caustic potash a strongly active gas remained, the volume of which increased to about twice its original volume in two weeks, after which no further increase occurred, though it still possessed activity. The effect is provisionally attributed to decomposition of the water by the emanation. [See also Abstract No. 2890 (1904).]
L. H. W.

83. *Photographic Registration of Effects of* N*-rays on the Electric Spark.* **R. Blondlot.** (Comptes Rendus, 139. pp. 843–846, Nov. 21, 1904.)—In order to prove that no effect is produced by the sheet of zinc used to support the lead screen or moistened paper in the author's earlier experiments on photographically recording the effect of the *n*-rays on the electric spark [see Abstract No. 292 (1904)], he calls attention to the fact that he showed in a later paper [see Abstract No. 2564 (1904)] that the photographic images with or without such zinc and moistened paper were identical. Further experiments are now described, in which a larger, fixed sheet of zinc, one half of which can be covered by the moistened paper, is used; the lead screen is suppressed. The photographic images obtained with this arrangement also were identical. Using an automatic device to regulate the time of exposure (so that one could never differ from the other by more than ½ sec. in 50 sec. total exposure), exposures were made, first without, and then with the *n*-rays acting, the duration in the former case (without the rays) being always purposely made ½ to 1½ sec. longer than in the latter. With the help of

C. Gutton twelve experiments at four different times were made on this method, the rays being produced by a Nernst lamp. In all cases the photographic image appeared first, and was stronger, on the part exposed to the rays, although the exposure given to these parts was slightly less than to the others. A similar result was obtained with only two exposures of 50 sec. These are considered irrefutable proofs of the reality of the action of the *n*-rays on the electric spark. L. H. W.

84. *Experiments to Detect the* N-*ray Effects.* **H. Bordier.** (Comptes Rendus, 139. pp. 972–974, Dec. 5, 1904.)—The author describes another method of photographically recording the effects due to *n*-rays, or at least the difference produced by the presence of a source of these rays. Drops of collodion containing a small quantity of sulphide are allowed to fall on a sheet of thin paper, an equal number on both halves of the paper. The paper is left in the dark overnight, and the next day exposed (dull day) for 5 to 10 min. A photographic plate wrapped in paper is then placed below the paper with the drops on the underside, and is put away in the dark with a knife-blade over one half and a piece (or small pieces) of lead, of the same weight and approximate shape as the blade, on the other half. After 24 hours the plate is developed; it shows dark spots corresponding to the drops, but each surrounded by a halo, which, however, is much larger in the case of those exposed to the action of the blade. Measures by M. Louis, of the Lyons University, gave for the spots 6·4 and 7·1, and for the halos 11·7 and 10·8 mm. in the two cases (exposure to blade and to lead respectively). The spots are thus smaller, and the halos larger, in the case of the *n*-rays acting. A similar exposure was made using a band of collodion, 8 mm. wide, on paper, cut into two parts. In this case the *n*-ray-exposed half not only showed a wider halo than the other half, but the image appeared earlier in the development.
L. H. W.

REFERENCES.

85. *Large Quartz Spectrograph.* **H. Lehmann.** (Zeitschr. Instrumentenk. 24. pp. 230–236, Aug., 1904. Communication from the Optical Workshops of C. A. Steinheil, Söhne, München.)—The author describes the construction and performance of a new quartz spectrograph of large aperture. The lenses were 40 mm. aperture and 400 mm. focus; a dispersion of 14° was obtained between λ6500 and λ1850, and on the photographic plate the distance between λλ5000 and 1850 was about 17 cm. A series of measures is tabulated and plotted showing the curvature of field for various spectrum colours. C. P. B.

86. *New Camera Objective for Spectrographs.* **J. Hartmann.** (Zeitschr. Instrumentenk. 24. pp. 257–263, Sept., 1904. Astrophys. Observatorium, Potsdam, July 18, 1904.)—Details of measures of zonal error of a new Zeiss camera objective are given, and a short discussion of qualities necessary for objectives used in spectrographs. C. P. B.

87. *Optical Testing by Hartmann's Zonal Method.* **H. Lehmann.** (Zeitschr. Instrumentenk. 23. pp. 289–301, Oct., 1903. Communication from the Optical Workshops of C. A. Steinheil, Söhne.)—In continuation of previous papers [see Abstracts Nos. 2031 (1902) and 789 (1903)], the author describes the application of Hartmann's zonal testing methods to the determination of the colour curve of an objective, to the determination of focal length, and to the construction of concave parabolic mirrors. Examples are quoted in illustration of the different tests. C. P. B.

88. *New Nautical, Topographical, and Astronomical Instruments.* **C. Pulfrich.** (Deutsch. Phys. Gesell., Verh. 6. 19. pp. 255–261, Oct. 15, 1904.)—The author discoursed on his instrument for determining the dip of the horizon [see Abstract No. 3184 (1904)], a new theodolite, portable in two parts, a photo-theodolite, and on applications of stereo-photogrammetry [see Abstracts Nos. 1384 (1903) and 305 (1904)] in the German Navy. A coast survey has been made from the *Hyäne*, and the photographs permit of measuring the clouds and water-waves. He finally referred to his new "flash" method of comparing star and other photographs. The two plates of the stereo-comparator are united in the common eyepiece of two microscopes, and easily changed or examined separately; any inequalities then become very striking [see Abstract No. 2149 (1904)]. This method is also recommended for comparing star spectra, scales, coins, and documents. H. B.

89. *Determination of Errors of Lenses.* **A. Kerber.** (Zeitschr. Instrumentenk. 24. pp. 236–243, Aug., 1904.)—The paper gives an analytical determination of the laws of residual errors for certain combinations of incidence. C. P. B.

90. *Theory of Radiation Pressure.* **M. Abraham.** (Ann. d. Physik, 14. 5. pp. 1039–1040, Aug. 23, 1904.) **W. Wien.** (*Ibid.* 15. 2. pp. 412–414, Oct., 1904.) —The author maintains his position and points out that, according to Maxwell's theory, Poynting's theorem holds for a surface at rest, but not for a surface in motion. [See also Abstract No. 2147 (1904).] The second paper is the closing article of the discussion on these subjects between M. Abraham and Wien, who here points out the various senses in which the term radiation may be used with respect to an accelerated charge, the distinctions being confessedly a pure question of definitions adopted. E. H. B.

91. *Magnetic Double Refraction of Colloidal Ferric Hydroxide.* **A. D. Denning.** (Electrician, 53. p. 828, Sept. 9, 1904. Abstract of paper read before the British Association, at Cambridge.)—Of a number of samples of colloidal ferric hydroxide, treated in various ways and examined in solution for magnetic double refraction, only one gave measurable results, these being obtained after evaporating the solution until it contained approximately 20 per cent. of iron. Better results were obtained with Bravais's iron, which apparently has not the same chemical constitution as colloidal ferric hydroxide. T. H. P.

92. *Lippmann Colour Photography without the Mercury Mirror.* **E. Rothé.** (Comptes Rendus, 139. pp. 565–567, Oct. 10, 1904.)—Photographs in colour have been obtained by a modification of Lippmann's process in which the mercury mirror is omitted, the reflecting surface being gelatine-air. The exposure varies from 2 hours downwards, an arc spectrum having been photographed in 15 min. The method, whilst simpler than Lippmann's, does not give such brilliant colouring. G. E. A.

93. *Theory of Rainbow due to Circular Source.* **K. Aichi** and **T. Tanakadate.** (Phil. Mag. 8. pp. 598–610, Nov., 1904.)—This paper is similar to that by the same authors noticed in Abstract No. 2146 (1904), but slightly expanded. An analysis is made of the extension of Airy's theory of a *point* source to the case of a light source of definite area, some practical data having been previously obtained by experimental observations with a cylindrical column of water or glass illuminated from a long slit. The colour distributions are materially changed by variations in the size of the drop, especially in the supernumerary bows. The supernumerary bows almost lose their colour, and as the source increases in size this feature becomes more marked. Intensity curves are given showing the distribution of the light fringes for point source and source of angular diameter equal to that of the sun's disc. C. P. B.

94. *Theory of Colouring Matters.* **J. Schmidlin.** (Comptes Rendus, 139. pp. 871–873, Nov. 21, 1904.)—Consideration of the auxochrome and chromophore theory of dyes leads the author to the following conclusion: A colouring matter is characterised by a molecule including a strongly exothermal group (auxochrome), which, by a special arrangement, induces at another part of the molecule the formation of an endothermal group (chromophore), which contains double aliphatic bonds, allowing a part of the molecule to vibrate by using, as motors, luminous waves of the same period. T. H. P.

95. *Optical Investigation of Passive Metals.* **A. L. Bernoulli.** (Phys. Zeitschr. 5. pp. 603–604, Oct. 1, 1904.) **W. J. Müller** and **J. Koenigsberger.** (*Ibid.* pp. 797–798, Dec. 1, 1904.)—The suitability of the method employed by Müller and Koenigsberger to investigate the nature of the surface of passive iron [see Abstract No. 2588 (1904)] is adversely criticised. Müller and Koenigsberger reply to Bernoulli's criticism, justifying their results. The probability that the surface layer on passive chromium [see Abstract No. 64 (1905)] consists of chromi-chromate is doubted, as being contrary to the laws of electrolysis. G. E. A.

96. *Variation of the Refractive Index of an Electrolyte during the Passage of a Current.* **H. Bordier.** (Comptes Rendus, 139. pp. 191–193, July 18, 1904.)—After allowing for the rise of temperature it is found that the refractive index is decreased by a current of several minutes duration, and other things being equal, the decrease is greater for a weaker solution. Also a greater current produces a greater decrease of the index. F. S.

97. *Limitations and Extensions of Law of Brightness.* **A. Schmidt.** (Phys. Zeitchr. 5. pp. 528–529, Aug. 15, 1904.)—A theoretical consideration of the points of difference between the author and Seeliger on the question of the diminution of brightness in proceeding from centre to edge of sun's disc. [See Abstracts Nos. 1370 and 1375 (1904).] J. W. P.

98. *Characteristic Sulphur Lines in the Photographic Spectroscopy of Minerals.* **A. de Gramont.** (Chem. News, 90. p. 140, Sept. 16, 1904. Paper read before the British Association at Cambridge.)—The author has previously shown that in the spark spectra of minerals the lines of the spectra of the metalloids appear as well as those of the metals. In the present paper are given the results of the photography of the spectrum given by galena and argyrose. Certain sulphur lines are visible upon the photographs, and these are given in the paper. E. C. C. B.

99. *Spectra of Gases at High Temperatures.* **J. Trowbridge.** (Elect. Rev., N.Y. 45. pp. 560–562, Oct. 8, 1904. Amer. Journ. Sci. 18. pp. 420–426, Dec., 1904. Paper read before the St. Louis International Electrical Congress.)—An account of the author's experiments and theories connected with the passage of heavy condenser discharges through gases [see Abstract No. 1340 (1904)]. E. C. C. B.

100. *Standards of Light.* **E. L. Nichols.** (Elect. Rev., N.Y. 45. pp. 655–660, Oct. 22, 1904. Paper read before the St. Louis International Electrical Congress.)—A review of the present state of knowledge upon the light standards for photometric purposes. E. C. C. B.

101. *Phosphorescent Zinc Sulphide.* **H. Grüne.** (Ber. Deut. Chem. Gesell. 37. pp. 3076–3077, Sept. 24, 1904.)—Although pure zinc sulphide is not phosphorescent, the addition of a trace of Cu, Ag, Pb, Bi, Sn, U, or Cd makes it become so. Cu, to the extent even of 1 in 10,000, produces a fine green phosphorescence; Mn, however, produces a yellowish-red phosphorescence, and the sulphide when scratched or rubbed glows spontaneously. L. H. W.

102. *Glowing of Blende under the Influence of Ozone.* **R. Schenck** and **F. Mihr.** (Ber. Deut. Chem. Gesell. 37. pp. 3464–3467, Sept. 24, 1904.)—It was found that Sidot's blende glows intensely and also scintillates when exposed to a small amount of ozonised oxygen. It also scintillates spontaneously, though feebly, when kept in a dark room away from radio-active influences. L. H. W.

103. *Radio-active Gas in the Wiesbaden Springs.* **F. Henrich.** (Zeitschr. angew. Chemie, 17. pp. 1757–1760, 1904.)—The gas and water from the hot springs are found to be distinctly radio-active. The stalactites present in the springs are also radio-active, and, unlike the water, do not become inactive on keeping, though they lose a portion of their activity. The water is rendered nearly inactive by boiling. L. H. W.

104. *Radio-activity and London Clay.* **S. Skinner.** (Nature, 70. p. 553, Oct. 6, 1904.)—Specimens of London clay from different districts when tested showed the presence of no marked quantity of active gas, whilst water from a deep well going below the clay to the greensand readily gave evidence of the presence of radio-active gas. The London clay appears to form a floor through which the radio-active gas does not penetrate. The experiments which were carried out by H. Cottam tend to support J. J. Thomson's view that the radio-activity of the gas of deep-well waters arises from the splitting up of a trace of soluble radium salt which comes up with the water. J. J. S.

105. *Polonium and Radium.* **R. J. Strutt.** (Nature, 70. p. 627, Oct. 27, 1904.)—An account is given of an experiment which tends to show that the polonium found in radio-active minerals is a product of the radium they contain. J. J. S.

106. *Radio-activity of Various Materials.* **R. J. Strutt.** (Phil. Mag. 8. pp. 618–619, Nov., 1904.)—Deposits and water from various places are tested for radio-activity. This property appears to be much commoner in the saline residues of waters than in rocks. R. S. W.

107. *Kinetic Theory and Radio-activity.* **A. H. Bucherer.** (Phys. Zeitschr. 5. pp. 730–731, Nov. 1, 1904.) **E. Bose.** (Ibid., pp. 731–732.)—Bose has drawn the conclusion that the rate of decay of the radium emanation is independent of temperature, basing his reasoning on the fact that the gas is monatomic [see Abstract No. 2613 (1904)]. The author criticises the reasoning by which this conclusion is reached. Bose replies to Bucherer's criticisms. R. S. W.

108. *Contemplation of Feebly Illuminated Surfaces in the Dark Room.* **F. P. Le Roux.** (Comptes Rendus, 139. pp. 270–272, July 25, 1904.)—The author points out that the disturbances of visual sensation by large phosphorescent areas, such as were used in *n*-ray investigations, are eliminated by reducing the area to a narrow line, preferably vertical in direction. He mentions certain precautions which should be taken before making observations of this nature. [See also Abstract No. 2176 (1904).] H. W. P. Y.

109. *Registration of* N-*rays by Photography.* **G. Weiss** and **L. Bull.** (Comptes Rendus, 139. pp. 1028–1029, Dec. 12, 1904.)—The authors have endeavoured to obtain a photographic record of an effect mentioned by Blondlot in one of his earlier papers [see Abstract No. 292 (1904)], namely, that the *n*-rays increase the brightness of a uniformly illuminated cardboard surface. With exposures of from 20 sec. to 5 min. no difference was observable between the *n*-ray affected portion and the unexposed portion. Such a negative result would, however, be expected, as Blondlot now agrees that the *n*-rays increase the visibility, not the luminosity, of a phosphorescent substance [see Abstract No. 2174 (1904)]. L. H. W.

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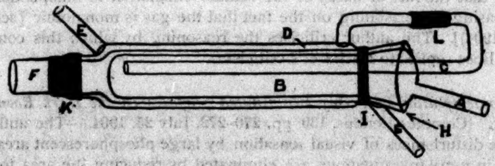
110. *Vapour Pressure Apparatus.* **J. J. Hutchinson.** (Roy. Dublin Soc., Proc. 10. 26. pp. 325–327, Sept. 17, 1904.)—An improved form of apparatus has been devised, consisting of a round-bottomed flask, fitted with a cork in which are bored three holes, through one of which passes a short piece of tubing bent at right angles, and provided with a tap or clamp, while the second serves for the insertion of a thermometer into the vapour, and through the third passes the long pressure-tube, the shorter arm of which, instead of just entering the flask, dips below the surface of the liquid, its end being contracted to prevent the rapid syphoning over of the liquid in the flask. In making a determination the liquid is heated to boiling-point, air and vapour escaping through the short tube, and when all air is expelled from the flask, the tap is closed. The pressure developed inside the flask now forces the liquid up the pressure tube and into the mercury tank, driving out all air from the tube. On removing the flame the pressure falls and mercury rises in the tube, a column of the liquid completely filling the part of the tube above the mercury. The vapour pressure is found from the mercury column, less the column of liquid from the surface of the mercury in the tube to the level of the liquid in the flask. The method has also been adapted to determining pressures greater than atmospheric by fitting another tube into the mercury tank, so that the liquid forced over from the flask cannot escape, but drives the mercury up the second tube. W. H. Sr.

111. *Improved Form of Condenser.* **H. E. Burgess.** (Chem. News, 90. p. 249, Nov. 18, 1904.)—A double-surface condenser is described, which is equally suitable for distillation under ordinary or diminished pressure, or with direct steam. It takes less than one-third the bench-room required by an ordinary Liebig condenser, may be used in any position, and can be readily cleaned. The accompanying diagram shows its construction, where A is cold-water inlet to B, the inner cold tube, C is outlet from this through L, a rubber joint, to D, the outer cold-water jacket, and E is outlet from the latter. F is the condenser tube, G being its exit. H is a ground joint, and I and K are rubber joints. W. H. Sr.



112. *Novel Form of Recording Pyrometer.* **N. S. Kurnakow.** (Zeitschr. Anorg. Chem. 42. 2. pp. 184–202, Nov. 21, 1904. Polytechn. Institut. Laborat. f. allgemeine Chemie, St. Petersburg. Translation.)—Describes a thermo-electric photographic recording pyrometer as set up at the St. Petersburg Polytechnic. In this installation the devices of Roberts-Austen and Stansfield have been only slightly modified and elaborated, the galvanometer, scale, and recording drum being placed in a separate dark-room, and so arranged that the scale can be observed by eye by means of a telescope passing through the wall of the dark-room into the laboratory. In order to retain the sensitiveness of the galvanometer over a wide range, the thermo-electric force of the couple is partially balanced by a counter e.m.f. from an accumulator. It is found that for temperatures near 1,000° C. a variation of 1 millivolt in the voltage of the accumulator produces an error of 0·5° C. in the record of the pyrometer, this error becoming more serious at lower and less serious at higher temperatures. Some cooling-curves obtained with the instrument are reproduced. W. Ros.

113. *The Maximum in Kraus's Conductivity Curves at High Temperatures.* **H. C. Jones.** (Amer. Chem. Journ. 31. pp. 584–585, May, 1904.)—In his investigations on the conductivity of solutions in methyl and ethyl alcohols below, at, and above the critical temperatures of the solvent, Kraus [see Abstract No. 1451 (1904)] found that as the temperature rises, the conductivity passes through a maximum. For methyl alcoholic solutions this maximum occurs at 150°, and for those in ethyl alcohol at about 100°. For the conductivity of two electrolytes in water at temperatures up to 306°, Noyes and Coolidge [see Abstract No. 867 (1904)] found that it increases rapidly as the temperature rises and that the degree of dissociation simultaneously falls. Rise of temperature increases the velocity of the ions but diminishes the association of the solvent, and hence its dissociating power and the maxima of Kraus's curves are the points where these two opposite influences become equal. T. H. P.

114. *Relation between the Saturation Specific Volumes of a Liquid and its Vapour.* **J. Pitsch.** (Akad. Wiss. Wien, Sitz. Ber. 113. 2a. pp. 849–860, June, 1904.)—Assuming van der Waals' form of characteristic but taking a, b, R to be functions of T, introducing new variables $x \equiv 8a/27b\mathrm{RT}$, $y \equiv b/(v-b)$, $z \equiv 8bp/\mathrm{RT}$, and employing Maxwell's rule, we easily find the relation—

$$(\log y_1 - \log y_2)/(y_1 - y_2) = (y_1 + y_2 + 2)/(y_1 + y_2 + 2y_1y_2)$$

between the specific volumes of saturated liquid and vapour; we further have—

$$\begin{aligned}27x &= 8(1 + y_1 + y_2 + y_1y_2)^2/(y_1 + y_2 + 2y_1y_2),\\ z &= 8y_1y_2(1 - y_1y_2)/(y_1 + y_2 + 2y_1y_2).\end{aligned}$$

Assuming the above relation, the author calculates the values of $1/3b$ for water at from 20° to 180° C., and for ether and CS_2 from 0° to 120° C., using the best known values of v_1 and v_2, and he finds that with exceeding great exactness b is expressible as $1/8\left\{\alpha\tau + exp(-\beta\tau - \gamma/\tau)\right\}$, where α, β, γ are constants, and $\tau \equiv \mathrm{T}^{3/4}$. The occurrence of a minimum value of b is indicated, which for water comes at about 60° C. [We can then easily obtain a and R also in terms of T.] R. E. B.

115. *Measurement of very Low Temperatures.* **B. Meilink.** (Konink. Akad. Wetensch. Amsterdam, Versl. 13. pp. 212–221, July 13, 1904. Proc. 7. pp. 290–299, Nov. 23, 1904.)—Describes the comparison of a platinum with a hydrogen thermometer. Baths of methyl chloride, ethylene, methane,

oxygen, and nitrogen were used, giving temperatures as measured by the hydrogen thermometer of from −51° C. to −209° C., and the resistance of the platinum thermometer was found to be expressed by—

$$R = 110{\cdot}45(1 + 0{\cdot}0038788t - 0{\cdot}0000009257t^2).$$

The conclusions to which the measurements lead are summarised as follows: A representation of the resistance by a quadratic formula according to the temperature, even if we do not go below −180° C., is only permissible when no higher degree of accuracy than 0·2° C. is aimed at. When a greater precision is desired, we require for the calibration of the platinum thermometer a greater number of points of comparison. For an accuracy within 0·02° C. at least six temperatures of comparison are desirable. Below −197° C. the deviations of the resistance thermometer became so large that before using it for this range an investigation must be made of the change of resistance as a function of temperature. W. W. H. G.

116. *Measurement of very Low Temperatures.* **B. Meilink.** (Konink. Akad. Wetensch. Amsterdam, Versl. 13. pp. 221–233, July 13, 1904. Proc. 7. pp. 300–311, Nov. 23, 1904.)—Describes the comparison of the resistance of a gold wire with that of a platinum wire. The gold wire was made of material provided by the assay-master-general of the Mint. No impurities could be detected in it by chemical means. The wire used was 0·1 mm. diam., but the great length needed rendered a soldered joint in the middle necessary. A glass cylinder was threaded with a spiral groove by coating it with a paste of oil and carborundum. The cylinder was made to grind on an iron or copper disc, which was kept in rapid rotation. A deep groove was thus obtained. On a cylinder of 37 mm. diam. and 55 mm. long, 12 m. of wire could be wound. Later still deeper grooves were obtained by etching. For the comparison a differential galvanometer was used in some of the experiments, in others a Wheatstone bridge method. In the results there is a striking difference between the Au and Pt, and though the values found do not help to fix the temperature-function of the gold, they show that the curvature of the line which for gold represents that temperature-function is much smaller than in the case of platinum, and that the curve is bent more towards the absolute zero. Hence a gold wire would be more suited for extrapolation than a platinum one. W. W. H. G.

117. *Air Radiation.* **C. C. Hutchins** and **J. C. Pearson.** (Amer. Journ. Sci. 18. pp. 277–286, Oct., 1904.)—The radiation from a heated air column 10 cm. thick in the line of sight is compared with that due to a lampblack surface. The method of producing the hot air column and of measuring its temperature is described. The standard of temperature is a lampblack surface at the temperature of the room. A modified Boys' radiomicrometer is used for measuring the radiation [see Abstract No. 1399 (1903)], and the absorption of the radiation by the air intervening between the hot column and the micrometer is determined and allowed for. The authors find that a column of air 245 cm. thick absorbs about 60 per cent. of the air radiation and that the remaining 40 per cent. suffers no appreciable absorption, however thick the column. By using M'Farlane's value for the radiation by a lampblack surface it is found that the heat radiated by a hot air column 10 cm. thick for zero absorbing column is 0·000000717 water-gramme-degrees per square centimetre per second per degree excess of temperature. S. G. S.

118. *Temperature of the Arc.* **C. W. Waidner** and **G. K. Burgess.** (Phys. Rev. 19. pp. 241–257, Oct., 1904. Communication from the National Bureau of Standards.)—The methods used in determining the temperature of the arc were based on the extrapolation of Wien's equation for the distribution of energy in the spectrum of a black body. The temperature of the brightest portion of the positive crater was thus estimated from photometric measurements made by means of the le Chatelier, Wanner, and Holborn-Kurlbaum pyrometers. The mean of several observations with the first-named was 3,720° abs., with the second 3,680° abs., and with the last 3,690° abs. The authors further found a small but perfectly definite rise in temperature with increase of current in the arc. The temperature also varied with the quality of carbon used, being rather higher with pure carbon than in the case of the ordinary commercial substance. E. C. C. B.

119. *Effect of Current upon Tensile Strength and Melting-point.* **P. R. Heyl.** (Phys. Rev. 19. pp. 281–292, Oct., 1904.)—The results obtained are negative. The change in the tensile strength of iron for a current density of 2,000 amps. per sq. cm. cannot exceed 0·5 per cent. For copper, with a current density of 1,000 amps. per sq. cm., the alteration cannot exceed 0·2 per cent. The change in the melting-point of tin for a current density of about 2,500 amps. per sq. cm. can hardly exceed 2° C. There is some reason to believe that there may be a small rise in the melting-point. R. A.

120. *Vapour Pressure of Sulphuric Acid Solutions and the Molecular Condition of Sulphuric Acid in Concentrated Solution.* **B. C. Burt.** (Chem. Soc. Journ. 85. pp. 1339–1354, Oct., 1904.)—The author gives the results of measurements of the total vapour pressures of sulphuric acid solutions, containing from 24·92 to 95·94 per cent. by weight of the acid, at various temperatures. When vapour pressure is plotted against temperature and concentration smooth curves are obtained, which are not, however, of any particular form and do not fit any simple mathematical formula. But when the calculated molecular weights are plotted against temperature and concentration the points obtained lie on a series of short, straight lines. It is not possible to draw continuous curves through them except in one or two cases, neither is it possible to fix on certain points as singular points or points of intersection of smooth curves. The figures obtained show that: (1) In no case does the calculated molecular weight of the sulphuric acid rise above 32·7, which would be expected for H_2SO_4 completely dissociated into three ions. (2) In most cases it lies far below this number and, contrary to expectation, it decreases with increase of concentration and increases with rise of temperature. (3) In the molecular weights calculated both from these and from Regnault's vapour pressure values, inversion points are occasionally found in a series where the direction of the change with temperature is reversed, as if some new factor had suddenly become of increased importance; these changes are most marked at the lower temperatures and concentrations, where no doubt exists as to the constitution of the vapour phase. From these facts the author draws the conclusion that, in solution, combination ensues between sulphuric acid and water with the formation of new complexes. T. H. P.

121. *Thermochemical Comparison of the Rosanilines and Leucanilines.* **J. Schmidlin.** (Comptes Rendus, 139. pp. 542–544, Oct. 3, 1904.)—Heats

of formation are given for the solid mono- and tri-hydrochlorides of the rosaniline-carbinols and for the solid leucaniline trihydrochlorides from the corresponding solid leuco-bases and aqueous hydrochloric acid. The heat evolved in the formation of the trihydrochlorides is greater, in all cases, for the carbinol salt than for the leuco-salt. With the carbinols the first molecule of acid taken up develops much more heat than the second or third, and this is more marked as the strength of the base increases. The heats of formation of the tetrahydroxycyclohexane salts from the rosaniline hydrochloride are also given. The whole thermochemical character of these compounds depends on the fact that the coloured molecule contains at the same time a strongly exothermic group and an endothermic one. The salt-formation of certain groups, to which Witt has given the name "auxochromes," leads to a special condition of the molecule which compels it to take up an endothermic chromophore group at some other point. T. H. P.

122. *Action of Certain Gases on Glass in the Neighbourhood of Heated Metals.* **G. T. Beilby.** (Chem. News, 90. pp. 180–181, Oct. 7, 1904. Paper read before the British Association at Cambridge.)—The decomposition of glass in the neighbourhood of heated metals when the products of combustion are allowed to come in contact with the glass appears to be due mainly to sulphur trioxide, but a lesser action is also produced by moist air. The influence of the heated metal is not easily explained. It might act as a catalyst in converting sulphur dioxide into trioxide, but this would hardly account for the localisation of the chemical action, which rather suggests the effect of a stream of projectiles. The suggestion is made that the effects observed are due to ionisation produced by the hot metal, charged particles of the metal being perhaps shot off from the surface and playing the double part of projectiles and of nuclei for the formation of sulphur trioxide. T. M. L.

123. *Energy of Water and Steam at High Temperatures.* **C. Dieterici.** (Phys. Zeitschr. 5. pp. 660–662; Discussion, pp. 662–663, Oct. 20, 1904. Paper read before the 76 Naturforscherversamml. zu Breslau, Sept. 20, 1904.)—A weighed mass of water, sealed up without air in a quartz tube, was heated to different temperatures in the range 100° to 300° C. and then dropped into a Bunsen ice-calorimeter, and from the observations a specific heat ι was deduced (which is practically the saturation specific heat of water) given by $\iota = 1{\cdot}0160 - 0{\cdot}00060572t + 0{\cdot}000004302t^2$, in terms of the mean calorie of which 100 raise a gramme of water from 0° to 100° C. Since $d\iota/dt$ varies as $t - 70{\cdot}4$, ι increases with the temperature, and the more the higher the temperature. ι really gives the rate of change of energy, and from its values and other data for water the isothermals of steam for temperatures 160°, 180°, . . 260° C. are drawn on an Ev-diagram. These all rise steeply from the saturation-points, but gradually become less inclined to the v-axis and for $v = 600$ c.cm. per gm. are nearly parallel to it, *i.e.*, the energy is then nearly independent of the volume and dependent on the temperature only: further, for large values of v they are practically equidistant, though not so for small volumes, whence the isometric specific heat of steam ($k \equiv \partial_v E/\partial t$) is independent of both v and t for large values of v, and it increases as the saturation-point is approached, but so as to be the higher the lower the temperature. The author thinks that this diagrammatic determination of k is of importance in determining the cohesion-pressure $\pi \equiv RT/(v - b) - p$ [but he wrongly states that $\partial E_T/\partial v = \pi$, which should be $\pi - \partial_v \pi/\partial T \equiv p - \partial_v p/\partial T$].

In the *discussion*, **Reinganum** claimed that he had shown that k has a maximum value at the critical volume by noting from Amagat's and Young's experiments that $\partial^2 p/\partial T^2$ there changed sign. The **Author** distrusted this result as derived from graphic differentiation, and, in answer to **Lummer**, stated that his results gave no indication of the relation between the ratio K/k and the temperature, though the isopiestic specific heat K behaved in its variations more or less like k. R. E. B.

124. *Further Comparisons of Gas Thermometers.* **P. Chappuis.** (Journ. de Physique, 3, pp. 833–838, Nov., 1904.)—Describes accurate comparisons of gas thermometers under constant pressure, carried out at the International Bureau of Weights and Measures. The experimental arrangement used is such as to eliminate the pressure of the atmosphere from the measurements, as the author regards uncertain variations of this factor as a source of error in previous work of this kind; the range of temperature was from 25° to 100° C., and the apparatus permitted measurements of the compressibility of the gases, within somewhat narrow limits, at any desired temperature. Hydrogen, nitrogen, and carbon dioxide were experimented upon. A summary of the results is tabulated in the paper. In the case of hydrogen it is found that there is no difference between the indications of constant-volume and constant-pressure thermometers at 20° and 40° C., but the compressibility of this gas was found to diminish slightly between 0° and 100°. In the case of nitrogen the divergence of the constant-pressure thermometer from the normal scale is nearly twice as great as that of the thermometer at constant volume. Further, at 0° nitrogen is more compressible than a perfect gas, but at 100° C. it is in the same condition as hydrogen at 0°. In the case of carbon dioxide the results show that when low pressures are employed the difference between constant-pressure and constant-volume thermometers becomes insensible, but under an initial pressure of 1 metre of mercury the divergence is six times as great as in the case of nitrogen under the same conditions of pressure. Experiments on the compressibility of carbon dioxide show that this gas only follows Boyle's law at high temperatures. The author points out that his results for carbon dioxide show certain irregularities for which he is unable to account, but he supposes that surface condensation played a part in causing them. W. Ros.

125. *Thermal Conductivity of Bismuth.* **F. L. Perrot.** (Archives des Sciences, 18, pp. 445–467, Nov., 1904.)—Two sets of experiments for determining the ratio of the thermal conductivities at right angles to and parallel to the axis of crystallisation are described. In the first set a pointed wire touches a smooth face of the material, which is coated with a layer of easily fusible material. The wire is heated by means of a Bunsen burner, and the material melts as the heat is conducted by the bismuth. The form of the boundary of the melted material, is an ellipse, whose major and minor axes are then measured. The square of the ratio of these axes is the ratio of the conductivities. As the result of a great number of measurements, the author obtains 1·848 as the ratio of the conductivity perpendicular to the axis to that parallel to the axis, using four different prisms of bismuth. In the second set of experiments a plate of bismuth lies on a heated surface. On the upper surface of the bismuth are two crystals which fuse at different temperatures. The time that elapses between the fusing of the two crystals is taken as

inversely proportional to the conductivity of the plate. The mean of these results gives 1·868. The third section of the paper is a note by M. C. Cailler, in which he shows mathematically that the assumption made in the second set of experiments is not justified, but that in the author's case the dimensions and conductivities are such that the error is probably about 2 per cent.
S. G. S.

126. *Physical Constants of Boron Trifluoride and Silicon Tetrafluoride.* **H. Moissan.** (Comptes Rendus, 189. pp. 711–714, Nov. 7, 1904.)—The author has applied the methods already described for phosphorus fluorides [see Abstracts Nos. 1448 and 1462 (1904)], to the purification and determination of the melting- and boiling-points of boron trifluoride and silicon tetrafluoride, with the following results :—

	Melting-Point.	Boiling-Point.
BF_3	$-127°$	$-101°$
SiF_4	$-97°$	—

The gases were prepared by the action of sulphuric acid on mixtures of calcium fluoride with boric anhydride and sand respectively, the BF_3 being passed through two copper cylinders containing sodium fluoride before entering the freezing apparatus, while the SiF_4 was freed from hydrofluoric acid by traversing a long glass tube filled with fragments of glass or glass-wool, and maintained at a red heat. As found by Olzewski, SiF_4, at atmospheric pressure, volatises without becoming liquid, as the temperature is raised, but under a pressure of two atmospheres, the fluoride melts at $-77°$ to a transparent, mobile liquid which boils at $-65°$ under a pressure of 181 cm. of mercury. For determinations at pressures greater than one atmosphere, the apparatus previously described was slightly modified, the end of the condenser passing into a tube half filled with mercury and closed with a tight-fitting cork, through which a glass tube is inserted dipping below the surface of the mercury to serve as a manometer. The results obtained have been confirmed for both salts by experiments on the fluorides directly synthesised by treating boron and silicon with fluorine. Employing Cailletet's method, the critical temperature of SiF_4 is found to be $-1·5°$, and the critical pressure 50 atmospheres. W. H. Si.

127. *Wetting of Cotton by Water and by Water Vapour.* **O. Masson.** (Roy. Soc., Proc. 74. pp. 230–254, Nov. 16, 1904.)—An exhaustive investigation of the thermal effects produced by immersion of cotton wool in water, or exposure to water-vapour, and of the amount of moisture absorbed during the latter. It is concluded (1) that the conspicuous rise and subsequent fall in temperature follow the same course in both cases, the temperature curve being represented by the equation $2\theta/\phi = t/\tau + \tau/t$, where t is the time from commencement of experiment, θ the corresponding temperature (measured from its initial value as zero), ϕ the maximum value of θ attained, and τ the corresponding value of t; (2) that previous moisture exerts the same influence in each case, and the temperature curves may then be regarded, in respect to their down slopes, as representative of later portions of the dry curve, though they do not quite coincide, showing that a permanent interference with the normal curve of the temperature is caused by interrupting the absorption process; (3) that the heating produced by exposure to water-vapour is the direct result of vapour absorption by the cotton, and is quantitatively connected therewith by the relation $dm/dt = c\theta + k \,.\, d\theta/dt$, in which t and θ have the same significance as above, m is the mass in mgm. of water absorbed, c the normal heat lost by the covered thermometer due to radiation, &c., per unit θ per min., and k its heat capacity; (4) that both absorption and heat production continue appreciably for many hours, though the rise in temperature is soon counterbalanced by radiation, &c., and that there is evidently no limit to the absorption process; (5) that the heat produced by the absorption is approximately equal to the heat of liquefaction of the same quantity of water; and (6) that in the case of immersion in water, though absorption of vapour cannot be observed, it must certainly occur, and that the air which adheres to each fibre, and fills all interstices, maintains that separation of water and cotton surfaces which is necessary for distillation to occur from one to the other. Experiments as to the effect of exposing cotton-wool in air saturated with vapour of absolute alcohol, and gun-cotton or glass-wool in moist air, show that the rise in temperature and absorption of liquid are much less than with cotton-wool in moist air, and the author dismisses as improbable the view that the moisture remains as a mechanically adherent film on the surface of the cotton, or that it enters into chemical combination with the cellulose, and considers that the vapour undergoes continuous osmotic diffusion into the substance of the fibre and forms with it what may be regarded as a solid solution of cellulose and water. W. H. Sт.

128. *Tension of the Carbonic Acid in Sea-water and in the Atmosphere.* **A. Krogh.** (Comptes Rendus, 139. pp. 896–898, Nov. 21, 1904.)—The tension of the CO_2 in sea-water is expressed as that percentage of CO_2 in an atmosphere which neither yields its CO_2 to the water, nor absorbs from it. Slight changes in the tension produce, according to the author's experiments, considerable changes in the state of dissociation of the bicarbonates and of the feebly bound CO_2. Assuming that the oceans contain on average $6{\cdot}55 \,.\, 10^{16}$ kg. of dissociable CO_2 in carbonates—27 times as much CO_2 as the atmosphere—he finds the following relation between the tension and the contents in dissociable CO_2: tension 0·01, 0·03, 0·05 per cent., CO_2 4·57, 6·55, $7{\cdot}36 \,.\, 10^{16}$ kg. On the Northern Atlantic the CO_2 tension is smaller in the water than in the air (0·023 against 0·03), and over the oceans in general smaller than over the continents; the sea therefore absorbs CO_2 from the atmosphere (Bohr), and could, if the difference in tension amounts to 0·001 per cent., absorb in one year $8{\cdot}85 \times 10^{12}$ kg., that is, more than all the industrial coal combustion produces. H. B.

129. *Radiation by Gases.* **W. Nernst.** (Phys. Zeitschr. 5. pp. 777–778; Discussion, pp. 778–780, Dec. 1, 1904. Paper read before the 76 Naturforscher-versamml. zu Breslau, Sept. 21, 1904.)—From some experimental results given by A. Langen on the variation with time of the pressure inside a bomb wherein a gaseous mixture has been exploded, the author calculates that the radiation of a certain mixture of water-vapour and air in the ratio 1·05 to 3·23 by volume is given by $2{\cdot}89 \times 10^{-9}(T^4 - T_0^4)$, while that of a black body of equal dimensions is only $7{\cdot}7/2{\cdot}89 = 2\frac{2}{3}$ times greater, and that the radiation of a mixture of 1·042 volume of aqueous vapour and 2·33 volumes of CO_2 was nearly that of a black body. In the *discussion*, doubt was thrown upon these conclusions. R. E. B.

130. *Clausius' Theorem for Irreversible Cycles, and the Increase of Entropy.* **W. McF. Orr.** (Phil. Mag. 8. pp. 509–527, Oct., 1904.)—The author discusses the difficulties attendant on a logical definition of the terms pressure, temperature, entropy, &c., for a fluid undergoing an irreversible process, pointing out that Planck, while giving one definition of reversibility, uses another; and he concludes that no definition of entropy has been given which is applicable to any states but those of relative equilibrium, and accordingly that any statement as to the increase of entropy should be restricted to a comparison between its values in such states—any statement that in an irreversible process the entropy *continually* increases being meaningless. He furthermore maintains that it has nowhere been logically deduced from clearly stated premisses (except by Planck, with a quite unusual definition of irreversibility), that when a system passes in an irreversible way from one equilibrium state to another without interchanging heat with external bodies, the entropy in the final state is greater than in the initial, and that for such deduction an additional premiss is necessary. Thus to Kelvin's version of the second law—that if a system in a cycle interchange heat with external bodies, it is impossible that in every interchange the system should receive heat—might be added a further statement to the effect that, if any process in the cycle is one which is actually possible with natural bodies, the system must at some stage give out heat. Finally, an objection is raised to the indiscriminate use of the thermodynamic potential in the treatment of problems of chemical equilibrium, such methods being unnecessarily complicated in principle, and their validity in many cases being questionable. R. E. B.

131. *Composite Mixtures and the Function a/b.* **B. M. van Dalfsen.** (Konink. Akad. Wetensch. Amsterdam, Versl. 13. pp. 167–181, July 13, 1904. Proc. 7. pp. 94–107, Aug. 26, 1904.)—A theoretical discussion based on the supposition that a and b are homogeneous quadratic functions. Assuming the Galitzine-Berthelot rule, the author finds that for $n=2$ there is no maximum, and a minimum is possible; $n=3$, there is no maximum or minimum, a stationary point is possible; $n=4$, no maximum or minimum, other stationary points are possible; $n=5$ and higher, all stationary points are impossible. H. H. F. H.

132. *Transformation of Phenyl Potassium Sulphate to Potassium* p-*Phenol Sulphonate.* **J. Olie, Jr.** (Konink. Akad. Wetensch. Amsterdam, Versl. 13. pp. 102–104, July 13, 1904. Proc. 7. pp. 328–329, Nov. 23, 1904.)—The change occurs on heating the potassium salt to 150°–160°, or the sodium salt to 130° in air when quite dry. In an air-free tube no change occurs at 260°. The salt appears to be especially susceptible to H ions. H. H. F. H.

133. *Critical Points of Dilute Saline Solutions.* **L. Levi-Bianchini.** (Accad. Lincei, Atti, 13. pp. 174–176, Aug. 7, 1904.)—The author finds that dilute solutions in methyl alcohol of the chloride, bromide and iodide of lithium, and of the bromide and iodide of sodium and potassium remain perfectly homogeneous at their critical temperature and beyond, his preliminary results confirming the conclusion of Centnerszwer [see Abstract No. 329 (1904)] that the critical temperature rises proportionally to the concentration. The chlorides of sodium, potassium, and strontium become insoluble below the critical temperature of the solvent, while chlorides of barium and calcium apparently undergo alteration and present complex phenomena.

The solvent decomposes chlorides of zinc, cadmium, copper, iron and nickel, sulphate of copper, and sulphocyanate of potash. With solutions of cobalt chloride in methyl alcohol, the salt remains dissolved in the vapour beyond the critical temperature, as Hannay and Hogarth also found for solutions of it in ethyl alcohol, but a gradual decomposition of the chloride occurs with the former, a white insoluble deposit being formed, and the critical temperature approaching that of the pure solvent. Experiments with acetone solutions of the chlorides of copper and cobalt, and of mercuric iodide proved fruitless owing to decomposition or insolubility at temperatures below the critical ones. The critical pressure of dilute solutions is found to be greater than that of the solvent, and increases with the concentration, which accords with theory. W. H. Si.

134. *Studies on Racemisation.* **G. Bruni** and **F. Finzi.** (Accad. Lincei, Atti, 13. pp. 349-355, Oct. 16, 1904.)—The author has already shown how, by examining the eutectic or cryohydric curves, we can distinguish whether two optical isomers form (1) a simple inactive conglomerate, or (2) a pseudoracemic series of mixed crystals, or (3) a real racemic compound. In Fig. 1 curves 1 and 2 correspond to the first two cases respectively; in Fig. 2 we have a representation of the case of a real racemic compound:—

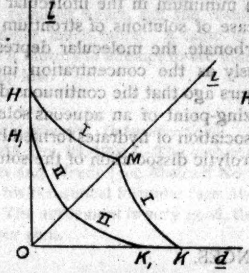


Fig. 1.

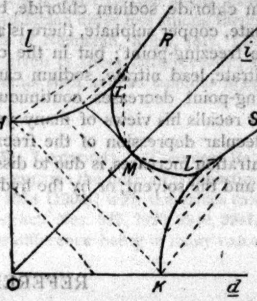


Fig. 2

For these curves there is a system of two orthogonal axes in the plane of the paper; each axis represents the percentage of one (*d*) or the other (*e*) optical isomer in the solvent—the bisector of the right angle between the two axes represents, therefore, solutions of the inactive substance (*i*). A third axis perpendicular to the plane of the paper serves to denote temperatures. In the present communication the authors give details of experiments with two pairs of optical isomers which show true racemisation, viz., diacetyl dimethyl tartrates in paraxylene or ethylene bromide solution and acid ammonium tartrates in aqueous solution. Curves of the form shown in Fig. 2 express the results obtained. The consideration of the effect of change of temperature on racemisation is left over for a subsequent communication. D. H. J.

135. *Molecular Elevation of the Boiling-point of Mixed Liquids.* **C. Marie.** (Comptes Rendus, 139. pp. 595-597, Oct. 17, 1904.)—The author shows that for solutions of resorcinol in mixtures of water and alcohol, the molecular elevation experimentally determined does not agree with that deduced from

Nernst's formula, in which $1/K_m = 1/K_1 \times q/100 + 1/K_2 \times (100-q)/100$, K_1, K_2 being the constants for the two solvents, q and $(100-q)$ their relative quantities by weight, and K_m the constant of the mixture, and the accuracy of the hypotheses on which this formula is based, is regarded as doubtful. The case of a body soluble in only one of the two mixed solvents, has been examined, employing solutions of benzophenone, acetophenone, naphthylamine, phenyl benzoate, alanine and asparagine in mixtures of alcohol and water, the first four being soluble in alcohol only, the two last in water only. For the first group the elevation of the boiling-point is proportional to the alcoholic concentration, and the molecular constant obtained is practically identical with that given by solutions in alcohol alone, but with bodies soluble in water only, a depression of as much as 1° has been observed.

W. H. Si.

136. *Molecular Depression of the Freezing-point of Water Produced by some very Concentrated Saline Solutions.* **L. C. de Coppet.** (Journ. Phys. Chem. 8. pp. 531–538, Nov., 1904.)—In view of the experiments recently communicated by Jones and Getman on the freezing-point of solutions [see Abstract No. 1090 (1904)] the author recalls a number of experiments carried out by him many years ago. His results show that in the case of solutions of ammonium chloride, sodium chloride, barium chloride, magnesium sulphate, zinc sulphate, copper sulphate, there is a minimum in the molecular depression of the freezing-point; but in the case of solutions of strontium nitrate, barium nitrate, lead nitrate, sodium carbonate, the molecular depression of the freezing-point decreases continuously as the concentration increases. The author recalls his views of many years ago that the continuous decrease of the molecular depression of the freezing-point of an aqueous solution, as the concentration increases, is due to dissociation of hydrates formed between the solute and the solvent, or by the hydrolytic dissociation of the solute.

A. F.

REFERENCES.

137. *Reversible Deep-Sea Thermometers.* **F. Grützmacher.** (Zeitschr. Instrumentenk. 24. pp. 263–268, Sept., 1904.)—The author has tested two Negretti and Zambra (London), one F. C. Jacob (Copenhagen), one V. Chabaud (Paris), and two C. Richter (Berlin) reversible thermometers. Some were provided with Knudsen's device for preventing reunion of the broken thread by concussion; but shaking brought the threads together again. The Richter instruments proved quite satisfactory, and the author thinks that reversible mercury thermometers should answer for all depths. H. B.

138. *Estimation of High Temperatures.* **W. Nernst.** (Phys. Zeitschr. 4. pp. 733–734; Discussion, p. 734, Oct. 24, 1903. Report read before the 75 Naturforscherversamml. at Cassel, Sept. 21, 1903.)—Reviews the several methods of measuring temperature and shows that a new method may be derived from the thermodynamic equation $Q = RT^2(d \log K/dT)$. W. W. H. G.

139. *Freezing-point and Conductivity Determinations of the Urine.* **Dreser.** (Zeitschr. Elektrochem. 10. pp. 656–660; Discussion, p. 661, Aug. 26, 1904. Paper read before the 11 Hauptversammlung der Deut. Bunsen Gesell. May 12–14, at Bonn.

T. H. P.

140. *Phosphorus Tribromide.* **A. C. Christomanos.** (Zeitschr. Anorg. Chem. 41. 2. pp. 276–290, Sept. 22, 1904. Universitätslaboratorium, Athens.)—Phosphorus tribromide may be prepared in a pure state by the action of bromine on yellow phosphorus in presence of benzene free from thiophene. It boils at 170·8° under 760 mm. pressure, and solidifies at − 41·5°, forming leafy crystals. Its index of refraction n_D = 1·6945°, and its density 2·88467 at 0° and 2·85234 at 15°, so that its coefficient of expansion is four times as great as that of mercury, and at 27° has the value 0·0007876. T. H. P.

141. *Mechanical Equivalent of Heat.* **H. T. Barnes.** (West. Electn. 35. p. 297, Oct. 8, 1904. Abstract of paper read before Section A of the St. Louis International Electrical Congress.)—Recounts the best experiments made with mechanically and electrically produced heat, discusses their differences, and fixes on 4·186 joules as the best equivalent for the mean calorie (*i.e.*, 1 per cent. of the heat required to raise 1 gm. of water from 0° to 100° C.). R. E. B.

142. *Specific Heat of Metallic Sulphides.* **E. van Aubel.** (Phys. Zeitschr. 5. pp. 636–637, Oct. 15, 1904. From the French.)—The author refers to Streintz's value for the mean specific heat of amorphous silver sulphide (in powder) [see Abstract No. 3214 (1904)], and points out that this value (0·0804) differs considerably from that required by the Joule-Kopp law (0·0706) if 6 is taken for the atomic heat of silver. The values obtained by Regnault, Sella, and Tilden differ less among themselves and from the required figure, but the results of Neumann, Kopp, Joly, Lindner, and Streintz differ much more. A table is given of these latter results; the author considers it illusory to attempt to use minerals such as lead sulphide to confirm the Joule-Kopp law. L. H. W.

143. *Calorimetric Determinations.* **P. Lemoult.** (Comptes Rendus, 139. pp. 633–635, Oct. 24, 1904.)—The author compares the heats of combustion obtained by Fischer and Wrede [see Abstract No. 2214 (1904)] with the values calculated by means of his theoretical formulæ [see Abstracts Nos. 327, 2920, 2940, 2941, and 2942 (1904)]. The agreement is very good, the difference being in many cases not more than 0·5 per cent. T. H. P.

144. *Dynamic Isomerism of α- and β-Crotonic Acids.* **R. S. Morrell** and **E. K. Hanson.** (Chem. Soc., Journ. 85. pp. 1520–1526, Nov., 1904.)—Experiments on α- and β-crotonic acids, with reference to the lowering of the freezing-point of one isomeride by the addition of the other, show that the freezing-point curve is regular and possesses a eutectic point at about − 3°. No mixture gives a freezing-point so low as − 20°, whilst the so-called *iso*-crotonic acid does not solidify at − 20°. T. H. P.

145. *Heats of Combustion of Triphenylmethyl and some Derivatives of Triphenylmethane.* **J. Schmidlin.** (Comptes Rendus, 139. pp. 732–733, Nov. 7, 1904.)—The numbers obtained by the author show that triphenylmethyl is a strongly endothermal compound, its heat of formation, $19C + 15H = C_{19}H_{15}$ (solid), having the value − 71 cals. T. H. P.

146. *Cryoscopy in Medicine.* **H. Schröder.** (Zeitschr. Elektrochem. 10. pp. 649–656; Discussion, p. 656, Aug. 26, 1904. Paper read before the 11 Hauptversamml. d. Deutsch. Bunsen Gesell., May 12–14, at Bonn.)—The author deals with the cryoscopic behaviour of the blood, urine, &c., under various conditions. T. H. P.

147. *Theory of Dilute Solutions Based on van't Hoff's Law: Osmotic and Cryoscopic Formulæ.* **E. Ariès.** (Comptes Rendus, 139. pp. 401–404, Aug. 8, and pp. 462–464, Aug. 29, 1904.)—Starting from van't Hoff's law on osmotic pressure and with the help of Gibbs' formulæ, the author derives mathematically, equations for the potentials h_0 and h_1 of the solvent and solute. In the second paper the author shows how to use the above formulæ to derive the equations used in osmotic and cryoscopic measurements. T. H. P.

148. *Effect of Mechanical Vibration upon CO_2 near the Critical Point.* I. **W. P. Bradley, A. W. Browne,** and **C. F. Hale.** (Phys. Rev. 19. pp. 258–272, Oct., 1904. Contribution from the Cryogenic Laboratory of Wesleyan University.) —The authors observed that carbonic acid near its critical point (contained in a Cailletet apparatus) exhibited a sudden formation of fog when the supports were subjected to a slight mechanical shock. This was traced to a vibration of the enclosing mercury column, which caused slight volume changes in the enclosed gas. The paper contains a study of this effect. F. G. D.

149. *Thermochemistry and Acidimetry of Methylarsenious Acid.* **A. Astruc** and **E. Baud.** (Comptes Rendus, 139. pp. 212–215, July 18, 1904.)—Thermochemical data are given for methylarsenious acid and its mono- and di-sodium salts. The replacement of the first hydrogen atom by sodium yields 46·37 cals., and the second, 43·04 cals. The acid gives an acid reaction with helianthin, phenolphthalein, rosolic acid, litmus, or Poirrier's blue. The acid reaction is only slight with helianthin, more distinct with phenolphthalein, but the colour change is not sharp enough for titration purposes. To rosolic acid or litmus the acid is monobasic, and to Poirrier's blue dibasic. T. H. P.

150. *Free Energy Change in the Case of Some Technically Important Reactions.* **H. v. Jüptner.** (Zeitschr. Anorg. Chem. 40. 1. pp. 61–64, June 23, 1904. K.k. technische Hochschule, Wien.)—The author modifies the equation arrived at by him in a previous paper. [See Abstract No. 2231 (1904).] This modification is due to the employment of le Chatelier's equation for the specific heat of retort carbon at higher temperatures (250°–1,000°) instead of his equation for lower temperatures (0°–250°). Reference must be made to the original paper for the modified equations. F. G. D.

151. *Action of Low Temperatures on Dyes.* **J. Schmidlin.** (Comptes Rendus, 139. pp. 731–732, Nov. 7, 1904.)—The author finds that when solutions of colouring matters are subjected to the temperature of liquid air, the fluorescent colour behaves in a different manner from the transmitted colour, thus supporting Stokes' theory that these two colours have quite different origins. T. H. P.

152. *Proposed Modification of the Perfect Heat-Engine Formula.* **L. Illmer, Jr.** (Frank. Inst., Journ. 158. pp. 367–391, Nov. 1904.)—The author, who makes the same assertions as other supporters of *energetics*, would exclude all cases in which temperatures less than the mean atmospheric temperature occur. R. E. B.

153. *Hugoniot's Adiabatic Law.* **E. Jouguet.** (Comptes Rendus, 139. pp. 786–789, Nov. 14, 1904.)—In continuation of a former note [see Abstract No. 2131 (1904)] it is shown that, if a discontinuity obeys Hugoniot's law, it is propagated with a speed greater than that of sound in the parts towards which it is moving, but less than that of sound in the parts which it is leaving behind, and that it consists of waves of compression only or of dilatation only according as $\partial^2 p/\partial v^2$ is positive or negative, the former case being that for ordinary fluids. R. E. B.

ELECTRICITY AND MAGNETISM.

THEORY, ELECTROSTATICS, AND ATMOSPHERIC ELECTRICITY.

154. *Solid Dielectrics.* **V. Crémieu and L. Malcles.** (Comptes Rendus, 139. pp. 790–792, Nov. 14, 1904.)—During Crémieu's experiments on electric convection very anomalous results were obtained which were finally traced to the effect of the dielectric with which the conductors were covered. The authors are now investigating this behaviour. A sheet of dielectric, D, is placed on a metal disc, A, which is connected to the internal coating of a Leyden jar. Above D, but not in contact with it, is placed a disc, C, which is insulated and connected to an electroscope. The inductive influence through D decreases with the time. If the dielectric has, before the experiment, no true or free charge, after the lapse of a few minutes it acquires a total charge of opposite sign to that on A, but does not show any free electrification. This is called the reactive charge. The time taken to obtain this charge may be accelerated by suitable means, and a means of eliminating the free charge that then appears is given. R. S. W.

155. *Electric Conductivity of Air and Quantity of Ozone Present.* **V. Conrad** and **M. Topolansky.** (Phys. Zeitschr. 5. pp. 749–750, Nov. 15, 1904. K. K. Centralanstalt f. Meteorologie and Geodynamik, Wien, Aug., 1904.)—Numerous determinations of the conductivity of the air by means of an apparatus by Elster and Geitel, and of the amount of ozone present by means of iodine paper are made, the total number of observations being 650. The numbers given are on an arbitrary scale in both cases. With one exception it is found that for increasing values of the quantity of ozone, the conductivity increases. In one case, the conductivity drops with a rise in the quantity of ozone. The authors put this down to the presence of fog. Owing to the uncertainty as to whether it is ozone that is causing the discolouration of the iodine paper, the authors suggest that their observations may be most usefully considered as establishing the connection between the quantity of ozone and the discolouration, rather than that between quantity of ozone and conductivity. S. G. S.

DISCHARGE AND OSCILLATIONS.

156. *Potential-Fall in Arc at Low Pressures.* **C. D. Child.** (Phys. Rev. 19. pp. 117–137, Aug., 1904.)—The arc was formed between two solid 12-mm. carbons enclosed in a glass globe of ellipsoidal form, 24 cm. long and 17 cm. in diam. at its circular section. The two carbons, mounted on iron rods, and two probe electrodes entered through rubber stoppers, sealed with shellac at low pressures, and closing three tubulars, one at each end and one at the middle of the globe. The probes and lower carbon rod were movable. The pressures used ranged between 780 mm. and 2 mm., measurements below 10 mm. being very uncertain. Potential differences were measured with a (5,000 ohm) Weston voltmeter, which was found to be allowable by comparison with an electrometer. The probe electrodes were of carbon 1·6 mm.

diam., except for pressures below 3 mm., when thin platinum wires were used. With a current of 10 amps. the anode drop was found to diminish continuously from 50 to 22 volts as the pressure was diminished from 730 mm. to 2 mm. ; whilst the kathode drop increased from 14·1 to 16 volts at 30 mm., and then diminished to 10 volts at 10 mm. The electric force through the arc was measured by a double probe with carbon prongs 4·5 mm. apart. It was found to remain about constant at 23·4 volts per cm. between pressures of 730 and 50 mm., and then to diminish between 50 and 2 mm. The temperature of the arc diminishes with pressure, but by using platinum probes it was shown to exceed the melting-point of platinum even at pressures as low as 0·5 mm., when a platinum wire of 0·01 mm. was fused. The discharge from the arc to a surrounding cylinder of iron maintained at a potential, differing from that of the arc by 54 volts, was found to increase rapidly with decrease of (gaseous) pressure ; but the discharge carried by the positive ions was the greater at atmospheric pressure, whilst that carried by the negative ions was the greater at low pressures. The author discusses the theory of the arc, reviewing his own observations and those of other experimenters, and points out that a high temperature is not essential at the anode, although on the whole it seems necessary at the kathode. If too much current is taken from the probe the arc will jump to it, but in order to replace the kathode in this way it must be much hotter than to replace the anode. Treating conduction through the arc and the potential fall at the electrodes from the ionic point of view, he gives reasons for believing that the number of ions leaving the electrodes is less than that passing through the middle of the arc, and that this is the cause of both the kathode and anode fall of potential, and of the greater value of the latter. He considers a high temperature to be an essential within the arc except when the pressure is very low and the mean free path of the negative ions may be sufficiently great to allow of ionisation by impact. [See Abstracts Nos. 1455 (1900) and 2000 (1904).] J. D. C.

157. *Ionisation of Gases and Vapours Produced by Polonium Rays.* **C. Böhm-Wendt.** (Phys. Zeitschr. 5. pp. 509–511, Aug. 15, 1904. II. Physikal. Institnt d. Univ., Wien, June, 1904.)—An account of observations on the current through different gases and organic vapours due to the presence of a small piece of polonium (radio-tellurium). The values, given in tables, of the saturation current agree with the hypothesis of Rutherford and Thomson that the ionisation in various gases is independent of the nature of the gas, and that all gases, if the whole of the radiation is absorbed, give equal values of the saturation current. The behaviour of ether vapour is however anomalous. J. J. S.

158. *Transmission of Kathode Rays.* **G. E. Leithäuser.** (Ann. d. Physik, 15. 2. pp. 283–306, Oct., 1904. Berliner Dissertation, 1903.)—Lenard and Seitz have separately come to the conclusion that the velocity of kathode rays is not altered by transmission through thin sheets of metal. The author repeats their experiments, using a homogeneous beam of rays obtained from a Wimshurst machine. Part of this beam falls on a fluorescent screen, and can be deflected by a magnetic field ; it is not drawn out into a spectrum. The remainder passes through sheets of aluminium and when deflected shows a spectrum, proving that the velocity of the rays is changed unequally. Further, the magnetic deflection depends on the ray velocity, while the electrostatic deflection depends on its square. If, therefore, one deflection

is just balanced by the other for a given velocity of the rays, a balance will obtain for no other velocity. Hence again the change in velocity is shown. The distribution of the current in the different parts of the spectrum is investigated. The current shows a maximum value for a certain velocity; this velocity depends on the potential difference which produces the rays. [See also Abstract No. 842 (1904).] R. S. W.

159. *Relative Ionisation Produced by Hard Röntgen Rays and γ-Rays of Radium.* **A. S. Eve.** (Phil. Mag. 8. pp. 610–618, Nov., 1904.)—The ionisation for hard Röntgen rays follows the density law much more closely than it does for the softer rays. The values obtained depend more on the hardness of the bulb than on the amount of lead the rays are allowed to penetrate before their ionising power is tested. Except for the case of hydrogen, the ionisation by γ-rays follows the density law closely. R. S. W.

160. *Oxidation of Nitrogen by the Electric Discharge.* **F. v. Lepel.** (Ber. Deut. Chem. Gesell. 37. pp. 3470–3474, Sept. 24, 1904.)—Using a current of 6 amps. at 14 volts it was found that the yield of acid (nitrogen oxide) per tube from two discharge tubes in parallel was about the same as from one tube by itself, but there was sparking at the rotating distributor, indicating a loss of energy, in passing from one electrode to the other. The flame was then subdivided by means of a forked anode (in a single tube) which was rotated on a broad kathode plate. Using an apparatus of this form (capacity 60 litres) and an air current (with steam) of 1,800–2,000 c.cm. per min., a yield of 2·419 gm. of acid was obtained in one hour from 100 c.cm. of condensed steam by the use of a current of 12 amps. at 70 volts. With two similar apparatus and the rotating distributor the yields were relatively made smaller (2·4 and 1·5 gm. from the two tubes taken separately), the maximum yield being 1·5 gm. per hour. The reason for the comparatively small yield with the large apparatus is held to be the need of determining for each size the most suitable values for the amount of energy, amount of air, and rate of rotation of anode. The experiments show, however, that with a rapid rotation of the anode a slower air current can be used; that such rotation is advantageous if moderately rapid; and that division of the flame is advantageous. A moderate supply of air should be used. [See also Abstract No. 1130 (1904).] L. H. W.

161. *Ozone Production in the Siemens Generator.* **A. W. Gray.** (Phys. Rev. 19. pp. 347–368, Nov., 1904. Ann. d. Physik, 15. 3. pp. 606–614, Nov., 1904. Phys. Inst. d. Univ., Berlin, April, 1904.)—A new form of apparatus is designed, in which the length of glass surface between the electrodes is largely increased so as to improve the insulation. The presence of water vapour causes various irregularities; a consistent series of readings can be obtained at one time, but these disagree with an equally consistent series taken a few hours afterwards. The mass of ozone formed per coulomb discharged through the gas increases proportionately to the voltage at the electrodes. The final conclusions are that in order to secure the best yield: (1) Good surface insulation must be secured both internally and externally. (2) Dry oxygen must be used. (3) Charging and discharging must be as sudden as possible. Merely placing the generator in parallel with the spark-gap of a machine is inefficient, because the charging takes place so slowly that no illumination, and consequently no ozone, is produced. [See also Abstract No. 602 (1904).] R. S. W.

162. *Influence of the Glass Walls on the Striated Discharge.* **E. Gehrcke.** (Ann. d. Physik, 15. 3. pp. 509–530, Nov., 1904. Communication from the Physikal.-Techn. Reichsanstalt, Charlottenburg.)—Previous work by Lummer and the author has raised the question how far the walls of the tube influence the light and mechanism of the discharge. The striated column is here investigated. The current is obtained from a large accumulator battery, so that the current i and current density d can be directly observed, as well as the diam. of the tubes and the separation of the striæ. The results are represented by curves. When p, the pressure, and i are constant the curve is a rectangular hyperbola, *i.e.*, the distance between the striæ varies inversely as the density of the current. When the diam. of the tube and the pressure are constant, the curve connecting current density and separation of striæ shows a maximum and minimum. It is concluded that the walls have an appreciable effect, and this is shown directly. The discharge is sent through a U-tube, one limb of which is covered internally with a conducting layer. The striæ in this limb are 50 per cent. closer together than in the other. It is finally concluded that the walls are essential to the formation of striæ, the kathode rays giving rise to a series of secondary kathodes along the sides of the tube. In some cases the gas itself may act as a secondary kathode. R. S. W.

163. *Recombination of Ions from Flames.* **P. Langevin** and **E. Bloch.** (Comptes Rendus, 139. pp. 792–794, Nov. 14, 1904.)—The ratio $\epsilon = \alpha/4\pi(\kappa_1 + \kappa_2)$ is measured for the ions in the gases from flames after the gases have cooled to atmospheric temperatures. Here α is the coefficient of recombination, κ_1 and κ_2 are the ionic velocities, and ϵ has been shown by Langevin to represent the ratio of the number of recombinations to the number of collisions. A modification of the method used by Bloch for the ions from phosphorus is used. The value of ϵ is found to be near 0·7; inferior to unity as theory requires, but more nearly equal to it than in the case of the ions produced by Röntgen rays on account of the smaller mobility of the ions. R. S. W.

164. *Mercury as Kathode for Electric Arc.* **J. Stark.** (Phys. Zeitschr. 5. pp. 550–551, Nov. 15, 1904.)—The author refers to a statement of C. D. Child [see Abstract No. 156 (1905)] to the effect that since mercury boils at 100° C. under a pressure of 0·29 mm., the temperature of the kathode can hardly be above this, whilst the author and Cassuto found that an arc could not be maintained unless the kathode could acquire a fairly high temperature [see Abstract No. 2670 (1904)]. It is then pointed out that the base of the arc has only very small area compared with the whole surface of the mercury which is acting as kathode, and with the given rate of production of heat, calculated from the current and p.d., the temperature of the mercury at the base of the arc must be fairly high. The author also examined the base of the arc spectroscopically. When the slit is near the kathodic base the spectrum is discontinuous, the mercury lines being prominent, but when the light received comes from the actual kathodic base a continuous spectrum is seen, which spectrum is very rich in red rays. The author concludes that the actual mercury which is acting as kathodic base is at a yellow or white heat. S. G. S.

165. *Thermal Ionisation of Salt Vapours.* **G. Moreau.** (Comptes Rendus, 139. pp. 916–917, Nov. 28, 1904.)—The velocity of the ions produced when salt vapours traverse a porcelain tube heated to 1000° [see Abstract No. 2001 (1904)] has been measured by passing the ionised vapour through two cylindrical condensers of the same diameter, and having a common interior electrode, one condenser being earthed and the other connected to an electrometer. By increasing the potential of the inner electrode, the current received by the cylinder attached to the electrometer rises, and reaches a maximum, then fading away. From the voltage corresponding to this maximum current, the velocity of the ions is readily calculated. In any part of their course, the positive and negative ions are found to have equal velocities, rapidly diminishing, for a solution of fixed concentrations, with increased distance from the hot region, and approximately as the density of the charged centres. With diminution of the latter, the mass of the ions increases, and also the number of molecules of neutral salt owing to recombination of ions. The velocity of the ions is greater in the vapour from more dilute solutions (for readily ionisable salts of potassium), being almost inversely proportional to the square root of the concentration, but increasing less rapidly for other salt solutions, a result which is analogous to that obtained with salts in a flame. The author concludes that in the neighbourhood of the region of ionisation, the velocity of the new ions is of the same order as that from salts in a flame, the ions being intermediate in character between those of a gas submitted to Röntgen rays and those from phosphorus emanation, approximating to the latter by the rapid decrease of the velocity.

W. H. Sı.

166. *Damping of Condenser Circuits Containing a Spark-gap.* **P. Drude.** (Ann. d. Physik, 15. 4. pp. 709–767, Dec. 6, 1904.)—A condenser circuit whose proper wave-length is sufficiently large compared to the length of the wire, and the condenser plates of which are sufficiently near to one another, sends out hardly any electric lines of force to the exterior, and consequently by the Poynting theory no energy is radiated in the form of Hertz radiation ; the damping is therefore determined solely by the total resistance, or if the conductors be not too thin, and a spark-gap be present, by the resistance of the spark-gap. Zenneck has shown [see Abstract No. 1740 (1904)] that the amplitude of a spark-gap-containing, closed condenser circuit does not follow the exponential law, the ratio of two successive amplitudes being greater for the later than for the initial oscillations. To save taking γ as a quantity increasing with t, it is assumed that the amplitude is proportional to $e^{-\gamma t/T}$ with γ constant. γ is then a mean value of the decrement. The knowledge of this mean γ is important in the use of Tesla transformers and in wireless telegraphy. The author then gives a full account of his experiments for determining γ by means of the properties of the spark-gap, using Bjerknes' method of taking the resonance curve (Wied. Ann. 55 p. 120, 1895) as being more convenient than that of Simons. The details of the method and apparatus are fully described and some resonance curves given as examples. The influence of the spark-energy-supplying conductors, of other incidental conditions of the spark-gap, and of the dielectric, the brush discharge and the construction of the exciting condenser upon the decrement are all considered at length, as well as the spark-gap resistance. The author gives a convenient summary of the results of this very extensive paper, of which the following contains the chief points. (1) In every spark-gap-containing condenser circuit there is a certain range of spark length which gives minimum damping, and within this range the primary decrement γ_1 is practically independent of the spark length. It can, furthermore, in all oscillatory circuits (with very different capacity and inductance) be brought to almost the same value if the spark is fed by a not too weak or too powerful coil, and

if the condenser shows no hysteresis or brush discharge. (2) This nearly constant value of γ_1 lies, in the case of zinc electrodes and small spark lengths (1–2 mm., or with very large capacity up to 4 mm.), between 0·05 and 0·08, and the ratio of C to L can even have the value 17. But to attain this low value of γ_1 the supply conductors must be short and close to the gap (no Righi supply with air-gaps). (3) The best condenser is formed by placing metal plates in petroleum. (4) Zinc electrodes show the lowest decrement after long use without cleaning. With spark coils a change of current direction increases γ_1; alternating current and a transformer gives as good results but not better than with a coil. (5) The integral effect of the exciting circuit in a resonance circuit first increases with the spark length, and then decreases; it depends much more upon the spark length than γ_1 does. (6) To obtain the greatest integral effect very small spark lengths must be used (even with $C = 36{,}600$ and very powerful sparking, 5 mm.; with smaller capacity, 1·5 mm.). The greater spark lengths used in wireless telegraphy are, the author considers, duc to the employment of the coherer which depends upon the maximum effect. (7) The spark resistance calculated from γ_1 depends very little on the spark length (within the specified range) but greatly upon the capacity and self-induction in the circuit; it decreases with increasing capacity and decreasing self-induction, as Lindemann found [see Abstract No. 357, 1904)], the resistance of the spark being 0·18 ohm for a length 1·8 mm. with large capacity and small self-induction, and 2·1 ohms for a length, 1·4 mm. with small capacity and large self-induction. Even with a constant energy supply to the spark, and constant capacity and spark length, the resistance of the spark depends very greatly upon the self-induction in the circuit. L. H. W.

167. *Absorption of Electric Waves.* **O. Berg.** (Ann. d. Physik, 15. 2. pp. 307–327, Oct., 1904. Habilitationsschrift. Phys. Inst. d. Univ., Greifswald, 1904.)—From a Blondlot oscillator two secondary systems of parallel wires were led, each ending in thermo-elements. One secondary system furnished a gauge of the working of the primary, and its thermo-element was connected to the whole length of a potentiometer wire. The other secondary passed through the liquid under examination, and its thermo-element was connected through a galvanometer to a portion of the potentiometer wire. The results for two strengths of potassium chloride are as follows :—

	KCl, $\frac{1}{20}$-normal.	KCl, $\frac{1}{100}$-normal.	
Temperature..................	14·4°	14·5°	16·9°
Conductivity in absolute electromagnetic units ...	$5{\cdot}349 \times 10^{-12}$	$1{\cdot}144 \times 10^{-12}$	$1{\cdot}201 \times 10^{-12}$
Absorption coefficient......	Calculated 0·146	0·0312	0·0334
	Observed 0·15	0·038	0·039

[See also Abstract No. 1874 (1902).] E. H. B.

168. *Radiation from Coils.* **E. Nesper.** (Ann. d. Physik, 15. 4. pp. 768–792, Dec. 6, 1904. Extract from Rostocker Dissertation.)—The author gives an account of an experimental investigation into the radiation from coils under various conditions, with a view to explaining a number of phenomena which occur in practical wireless telegraphy. The receiving instrument was a

Klemenčič type thermo-element, and an armoured galvanometer, two harps of parallel wires being used for the antenna and equivalent earth. The results cannot well be abstracted, but the following are the chief conclusions from the author's summary: (1) The radiation and reception of horizontally polarised waves (of magnetic force) is considerably greater than that of vertically polarised waves. (2) The character of the radiation from a coiled-up wire is practically the same as that from a straight wire. The radiation, and consequently the effectiveness of a coil is greater, other conditions being equal, the smaller the diameter [as Slaby has previously shown, see Abstract No. 218B (1904)]. The energy emission of a pair of coils wound in the same sense is infinitely small beyond about half a wave-length. (5) The thermocouple is unsuitable for measuring such slowly-following impulses (as when considerable capacity is used). (6) A mirror (of wood) brought up behind the radiator shows distinct maxima and minima of energy transmitted, as a function of the distance between oscillator and mirror, suggesting a possibility of measuring the wave-length of coils and antennæ by this means. (8) The immersion of the coils in liquids of different dielectric constants effects considerable changes in the amount of radiation, but owing to the conductivity of the media no definite relation could be established L. H. W.

ELECTRICAL PROPERTIES AND INSTRUMENTS.

169. *Calculation of the Capacity of a Plane Condenser of Finite Dimensions.* **N. Boulgakow.** (Acad. Sci. St. Petersburg, Mém. 15. 3. pp. 1–25, 1904.)—The condenser consists of two exactly similar conductors, each having part of its surface so nearly plane that it may be considered to be absolutely so. Each conductor is a surface of revolution whose shape is calculated. If two equal ellipsoids of revolution are situated with their axes of revolution in line, their major axes being at right angles to the axis of revolution, and equal and opposite electrical charges are supposed to reside on them, the equipotential surfaces for this distribution of charge may be found. The author then considers a conducting surface to coincide with one of these equipotential surfaces, the total charge on which is equal to the charge on the contained ellipsoid, the potential being that due to the original charged ellipsoid. The two surfaces found in this way are nearly plane where they cut the axis, but the plane area is in general surrounded by a protuberance. The author then proceeds to find the condition that these protuberances may be absent. The strength of field on the plane of symmetry is calculated, and the condition found, for which this decreases continuously on passing away from the axis of rotation. When this condition is fulfilled, the distance apart of two proximate equipotential surfaces increases on passing outwards from the axis, and hence no protuberance exists. The direction of the lines of force surrounding the conductors are then calculated, as well as the charge corresponding to each tube of force, and hence to any circular surface whose centre is on the axis. Tables for constructing the surfaces and the lines of force are given.

S. G. S.

170. *Measurement of Self-induction of Coils.* **A. Heydweiller.** (Ann. d. Physik, 15. 1. pp. 179–183, Sept., 1904. Physik. Inst. d. Univ., Münster, July, 1904.)—This is a method of measuring the coefficient of self-induction, in which is applied the Helmholtz equation of the rise of current in a circuit closed on a source of continuous pressure. The coil whose self-induction is

required and a known non-inductive resistance equal in amount to that of the coil are joined, in turn, to a battery, shunt-type ammeter, and rotating interrupter connected in series. The measurements taken are: (1) The value of the continuous current with the interrupter stationary; (2) its average value with the interrupter rotating in series with the non-inductive resistance; (3) the speed of the interrupter. These three, with the contacts per revolution of the interrupter, enable the duration of contact to be determined. (4) The average value of the current when the non-inductive resistance is replaced by the coil, the interrupter rotating as in (2). A simple application of the Helmholtz equation then enables the coefficient of self-induction to be determined. Examples of measurements on coils containing solid and split iron cores are given, which show the influence of eddy-currents in the core in diminishing the apparent self-induction. J. D. C.

171. *Conductivity of Sodium and Potassium Chloride in a Mixture of Ethyl Alcohol and Water.* **B. Schapire.** (Zeitschr. Phys. Chem. 49. pp. 513–514, Oct. 7, 1904.)—To obtain the migration velocities, the conductivities of $\frac{1}{30}$ to $\frac{1}{900}$-N sodium chloride in ethyl alcohol of 10, 20, 25, 30, and 40 per cent. by volume, and also of $\frac{1}{30}$ to $\frac{1}{900}$-N potassium chloride in ethyl alcohol of 20, 30, and 40 per cent. by volume, were determined at 18°. The velocity number increases with the increase of alcohol. The molecular conductivity decreases on addition of alcohol, the decrease being smaller when much alcohol is already present. The formula $(\Lambda_\infty - \Lambda)/\Lambda^p = c\eta^{1/2}$ gives good results. With sodium chloride, p slowly sinks, reaching a minimum with 25 per cent. alcohol, then slowly rises; c varies about as much, but inversely; Λ_∞ decreases with increasing alcohol content. With potassium chloride, p increases with moderate rapidity, reaching a maximum with 25 per cent. alcohol, afterwards it falls; c varies inversely, and Λ_∞ decreases. The ratio $\Lambda_{H_2O}/\Lambda_{\text{alcohol}}$ is not constant, but falls with the increase of V. Since with the most dilute solutions ($V = 600$ and 900) this ratio is not constant, one concludes that the mobility of the ions and the ionisation are diminished by the addition of alcohol. The temperature coefficient increases slowly with the increase of V, rapidly with the increase of alcohol. The Wakeman formula $\Delta/p(100 - p) = \text{constant}$, holds for the solutions of sodium chloride examined, Δ being the decrease of the ion-velocity, p the volume percentage of alcohol. None of the three ionisation equilibrium formulæ give good results if Λ/Λ_∞ is taken for the ionisation. A list of previous papers bearing on this work is given. F. S.

172. *New Method of Damping Oscillatory Deflections of a Galvanometer.* **W. Einthoven.** (Konink. Akad. Wetensch. Amsterdam, Versl. 13. pp. 284–293, Oct. 6, 1904. Proc. 7. pp. 315–323, Nov. 23, 1904.)—In order to produce damping, a condenser is connected across the galvanometer terminals. There is no mathematical discussion given, but the author has studied experimentally the effect of using varying capacities of condenser and resistance of circuit. The deflection is recorded on a photographic plate moving with uniform velocity, so that the deflection and time axes are at right angles to each other. With increasing time constant the damping increases, the deflection, however, being unchanged. With the author's "chord" galvanometer of resistance 8,600 ohms and an external resistance of 1,327 ohms, a capacity of 0·7 microfarad gives a time constant of 0·80σ, and the motion is aperiodic, having just passed the condition of critical damping. The deflection becomes steady after 0·002 sec. The method is not applicable to the ordinary

long-period moving-coil galvanometer, owing to the enormous capacity that would be required to produce critical damping. The natural period of the chord galvanometer in the case given above is of the order of $2{\cdot}0\sigma$, *i.e.*, 0·02 sec. S. G. S.

173. *International Electrical Units.* **F. A. Wolff.** (Elect. Rev. 55. pp. 724–726, Oct. 28, 1904. Abstract of paper read before the St. Louis International Electrical Congress.)—A review of the efforts made to uniformly define the fundamental electrical units. The resolutions of the 1893 Chicago Congress are discussed, together with the variations introduced in the definitions by the various Governments represented there. The absolute unit of resistance is objected to; for it, it is proposed to substitute the mercurial unit as defined in 1893. Analysis of various definitions of the ampere show that it has been defined in three distinct ways, of which the most common is in terms of the silver voltameter, the specifications for which are utterly insufficient. Objections are raised against the ampere being defined as the second fundamental unit. For this latter the volt is advocated, and the displacement of the Clark by the Weston cell is regarded as certain. A specification for the Weston cell follows, the important feature being the preparation of mercurous sulphate electrolytically [see Abstract No. 2276 (1904)]. The definitions of a few derived units are also briefly dealt with. F. E. S.

174. *Relation between Current, Resistance of Circuit, Efficiency, and Discharge Potential of Influence Machines.* **H. Wommelsdorf.** (Phys. Zeitschr. 5. pp. 792–796, Dec. 1, 1904.)—The first part of the paper comprises a description of the influence machine designed by the author [see Abstract No. 828 (1903)]. In the second part the author describes the measurements undertaken in order to determine the efficiency under various conditions. The results are presented in the form of curves. The author applies the name "characteristic" to the ampere-volt curve. This is practically a straight line. When making one revolution per second the maximum current is about 28 microamperes, and occurs with a sparking p.d. of 20,000 volts. The efficiency is nearly uniform from 50,000 volts to 110,000 volts, its value being about 25 per cent. At voltages above this, the efficiency falls rapidly. S. G. S.

175. *Electrolytic Rectifiers.* **A. Nodon.** (Electrician, 53. pp. 1037–1039, Oct. 14, 1904. Abstract of paper read before the St. Louis International Congress.)—The author commences by giving a general review of the valve effect, pointing out those metals which are most suitable for the purpose, *i.e.*, those in which the valve effect is obtained under a high difference of potential. The choice of electrolyte is also important owing to the fact that the nature of the secondary products of the electrolytic action has to be considered. With aluminium the best action is obtained with neutral ammonium phosphate; with magnesium saturated solutions of alkali fluorides give the best results. Tables are given of values of the applied p.d., the terminal p.d. when a continuous current is reversed, and of the current passing from various metals as anode to graphite as kathode, and inversely, in different electrolytes. From these it is seen that (1) Mg, Cd, Bi and Sb do not give rise to a valve effect; (2) only the carbonate, phosphate, or oxalate of ammonium produce the desired result; (3) an increase of internal resistance occurs on opening the circuit or reversing the current. Results are given of experiments on the resistance of cells with kathodes of different metals and with different electrolytes; and also on the influence of the electrolyte. These show that the specific resistance of ammonium neutral phosphate and carbonate are about equal (6–9 ohms per cm.^{3}); the resistance between the Al and the passive kathode at moment of reversal is about three times that of the electrolyte, and then increases up to the maximum limit; rectification is complete up to about 80° C., the leakage increasing above this point. Curves are given of the results of investigation of the action by means of the ondograph, and the use of a bridge arrangement as well as the practical form of the rectifier as made by the Mors Company, are briefly dealt with. [See also Abstract No. 177 (1905).] L. H. W.

176. *Action of Electropositive Metals on Potassium Iodide.* **F. Streintz.** (Phys. Zeitschr. 5. pp. 736–737, Nov. 1, 1904.)—Blaas and Czermak had attributed the action of zinc on sensitised paper and on potassium iodide to an occlusion of ozone and to a formation of H_2O_2 [see Abstract No. 2559 (1904)]. The author explains the phenomenon by the electrolytic solution tension. When characters are scratched on magnesium, and the metal is placed on paper impregnated with KI, the paper turns brown in a few minutes, with zinc in a few hours; an aluminium ring, freshly polished, also gives a picture in a few minutes (which contradicts Czermak), and on being shifted a faint second and even a third picture. The effect is of the character of a radiation which does not penetrate through mica, glass, tinfoil, but passes through paper. Magnalium acts more energetically than Al; Fe, Ni, Sn, Pb, Cu, Hg, Au, Ag, Pt have no effect. Characters painted with graphite on Mg are reproduced; marks drawn with Mg on Zn (or *vice versa*) not. A couple Mg|waterfilm|graphite would have a distinct e.m.f.; combinations between Zn and Mg would have a feeble e.m.f. only. H. B.

177. *Electrolytic Aluminium Rectifiers or Valve-Cells.* **F. Fischer.** (Zeitschr. Elektrochem. 10. pp. 869–877, Nov. 11, 1904. Extract from Berichte der Naturforschenden Gesellschaft zu Freiburg i. B.)—The author used Al-wire anodes in sulphuric acid with Pt kathodes, and raised the potential difference until the valve action deteriorated. The inversion occurred in an acid boiling at 105°, at 25 volts and at 109°, and the breakdown is a temperature effect, due to the destruction of the protective skin forming on the Al; for with a water-cooled tubular Al-electrode, the cell stopped 220 volts, the skin remaining intact. The effect is essentially due to a transition resistance, which was equivalent, *e.g.*, to a loss of 70·6 volts, and not to a polarisation, which amounted to 3 volts only, as with ordinary anodic polarisation the resistances of the skins vary directly as their thicknesses. When in these experiments the direction of the current was frequently reversed, the current intensity sank finally always to about 0·14 amp., independent of the voltage, and this final current intensity seems to be a measure of the velocity with which the skin is redissolved by the electrolyte. According to Norden the skin is $Al(OH)_3$; the author questions Norden's view of its formation in sulphuric acid, but did not chemically analyse the skin; any such skin of $Al(OH)_3$ would be dried on the anode by electric osmosis. [See also Abstract No. 175 (1905).] H. B.

178. *Differential Telephone.* **H. Ho.** (Phys. Rev. 19. pp. 166–170, Aug., 1904.)—The paper consists of some remarks on the above instrument, elicited by the publication of an article by Duane and Lory on the compari-

son of inductances [see Abstract No. 1516 (1904)]. It is important to wind the telephone coils with twin wire so that they are magnetically and ohmically equivalent. When this is so and balance is obtained, their self-inductances are neutralised completely by their mutual inductance and they act as non-inductive resistances, and so may be shunted according to the ordinary laws of shunts. Two inductances may then be compared by using the telephone as a differential galvanometer, but with a source of alternating currents. They may either be connected in series with the two telephone coils and then in parallel to the source, or both in series with each other and the source, with the telephone coils connected in opposite senses to their terminals, as in the ordinary method of comparing resistances by fall of potential. The latter method is the more accurate. In both cases the ohmic resistances in series with the telephone coils must be first adjusted to equality. A proof is then given of a method of comparing two capacities, C_1 and C_2, in which the parallel connection is used, with the telephone coil in series with C_2 shunted by a resistance R. If r is the resistance of each coil, and R the value of the shunt necessary to produce balance, then the capacities are connected by the simple relation $C_2/C_1 = (r + R)/R$. Considerable sharpness of balance is obtained and very small capacities and inductances may be compared. The author believes the instrument will become an essential in laboratory equipment. J. D. C.

179. *Dynamometer for Rapid Electric Oscillations.* **N. Papalexi.** (Ann. d. Physik, 14. 4. pp. 756–771, Aug. 2, 1904. Physikal. Inst., Strassburg, Feb., 1904.)—The first part of the paper is theoretical, and furnishes the principles of the apparatus whose construction and behaviour are described in the second or experimental part. The induction-dynamometer has a bifilar suspension which carries a light horizontal cross whose arms bear four square coils of aluminium foil. This cross (or "needle" of the instrument) lies between an upper layer of four circular coils and a lower layer also of four coils. The four coils of the upper layer are not exactly over those of the lower, but displaced by a rotation about a vertical axis. The needle in its zero position is at an intermediate angle between those of the two layers of coils. The author finds the dynamometer to compare favourably with the bolometer as to sensitiveness, proportionality, and constancy of zero, and is free from the objection of needing a sensitive galvanometer as an auxiliary instrument. E. H. B.

180. *Automatic Potential Regulator.* **A. W. Gray.** (Phys. Rev. 19. pp. 344–346, Nov., 1904. Ann. d. Physik, 15. 3. pp. 602–605, Nov., 1904. Physik. Inst. d. Univ. Berlin, April, 1904.)—This device is intended to be used with an influence machine for automatically keeping the potential between two points at a constant value. It is intended to supersede the ordinary point overflow to earth. A disc A is suspended vertically from a hinge, and is connected below with conducting liquid, which serves to damp it and also to make an electrical connection to it. Opposite to A is another disc, which is fixed, and through which project a number of needle points. The distance between A and the points is adjustable. The points are connected to the negative and A to the positive pole of the influence machine. If the potential rises, the disc A is attracted, and a more rapid discharge takes place from the points; if it decreases then the electrostatic attraction on A is overcome by means of a spiral spring attached to the back of this disc, with consequent slower discharge from the points. R. S. W.

181. *Sensitive Moving Coil Galvanometers.* **W. P. White.** (Phys. Rev. 19. pp. 305–329, Nov., 1904.)—The relations between periodic time of swing of the moving parts, moment of inertia, controlling couple, and electromagnetic constant for maximum efficiency are obtained. Since the galvanometer is most efficient when the damping is critical, and in the suspended coil type the damping is chiefly electromagnetic, the magnetic field may be increased in strength up to a certain point with advantage, but after the swing has become aperiodic, any further increase in the field has a detrimental effect. The radial field is preferred, as in this case magnetic impurity in the wire has a minimum effect. In the latter part of the paper various devices for reducing the disturbing effect of tremors are described and discussed. The author finds that a greater stability is attained by an arrangement supported by a basement floor than by one hanging from a wall or ceiling. A jointless table is described, which forms a simple means of taking advantage of a fairly stable floor. S. G. S.

ALTERNATING CURRENTS AND MAGNETISM.

182. *Diurnal Variation of the Magnetic Elements in Batavia, and Sun-spots.* **J. Liznar.** (Akad. Wiss. Wien, Sitz. Ber. 113. 2a. pp. 791–848, June, 1904.)—Ad. Schmidt expressed, in 1888, the diurnal variations of the three components in periodic series whose coefficients appeared as functions of the sun-spot numbers. His calculations were based on seven years of observations conducted at Vienna, and four and a half years at Batavia. The author analyses the Batavia records of 1883 to 1899 in a similar way, making his calculations for the north (X), east (Y), and vertical (Z) components. He finds that any change in the state of the sun, as shown by a change in Wolf's numbers, affects both the amplitudes and phases of those components. He assumes sun-spot periods of eleven years, of nearly thirty-three years, and of an unknown length ; on account of this complexity, the changes in amplitude and phase are not always the same for the same relative number, and he gives formulæ for reducing the magnetic elements for different states of solar activity. The paper is essentially tabular. After completing it, the author became aware of Angot's analysis of the diurnal variation of the magnetic declination, referring to the same period, and he regrets that Angot did not consider the three components. H. B.

183. *Magnetisation of Contact and Crystalline Structure.* **M. Brillouin.** (Annal. Chim. Phys. 3. pp. 305–335, Nov., 1904.)—A theoretical discussion of the structure of matter arising from the results obtained by Maurain as to the magnetic action on thin electrolytic deposits of various metals on a kathode in a magnetic field [see Abstracts Nos. 1112 and 1372 (1902)]. It appears from these experiments that the structure of the kathode deposit is granular so that at small distances the actions of poles must be more complicated than is given by Coulomb's Law. Long mathematical reasoning on this point is given, which shows that we can explain results if we superpose an action, of energy $= Q . \frac{\cos \lambda' r}{r} . mm'$ on that given by Coulomb's Law, of energy $= mm'/r$. Q is a numerical coefficient and λ' is the inverse of a length. It turns out that Q is a very small number, and $2\pi/\lambda'$ is very little greater than the distance between two consecutive molecules. P. E. S.

ELECTROPHYSIOLOGY AND ELECTROTHERAPEUTICS.

184. *Electromotive Forces Produced at the Surface of Animal Membranes in Contact with Various Electrolytes.* **G. Galeotti.** (Zeitschr. Phys. Chem. 49. pp. 542–562, Oct. 7, 1904.)—The author has carried out a number of experiments on the permeability of animal membranes for different ions, and the electromotive forces produced at the membranes. The method employed was to divide a cell into two compartments, by means of an animal membrane (frog's skin), the two compartments being then filled with the same salt solution. The two compartments were then connected with mercury electrodes, so as to obtain cells of the type Hg, HgCl, KCl | membrane | KCl, HgCl, Hg. It was found that an electromotive force was produced only when the membrane was alive; so that with certain salts which exert a toxic action, the first electromotive force gradually diminished. The results obtained may be summarised as follows:—

Salt.	E.M.F. in Millivolts.	Salt.	E.M.F. in Millivolts.
KCl	0	KNO_3	− 2·9
NaCl	+ 28·7	$NaNO_3$	+ 30·9
LiCl	+ 45·3	$Ca(NO_3)_2$	− 6·5
$CaCl_2$	+ 11·6	K_2SO_4	+ 17·1
KBr	0	Na_2SO_4	+ 25·6
NaBr	+ 32·0	$MgSO_4$	+ 6·5
KI	0	$K_2C_2O_4$	+ 3·5
NaI	+ 47·0	$Na_2C_2O_4$	+ 4·3

The positive sign indicates that the outer surface of the membrane was negative; the negative sign, that the inner surface was negative. The sodium and lithium salts give the highest values of e.m.f (K_2SO_4 excepted). Further, it is of interest to note that the skin of a frog gives no e.m.f. with KCl, KBr, or KI. The difference in behaviour with NaCl and KCl, for example, can be easily explained on the assumption that the membrane is permeable in both directions for K· and Cl′, but it is permeable for Na· only from outside to inside. This has been shown by direct experiment to be the case. The author also carried out experiments in which the animal membrane separated solutions of different salts. The results obtained showed that when a dead membrane is employed, the e.m.f. obtained agreed with that calculated for the contact potential for two liquids, but that when the membrane was living the magnitude and direction of the potential is altered. The paper is worthy of careful study by all interested in the application of physical chemistry to the problems of physiology.

A. F.

185. *Variations in the Form of the Boundaries of Pleural Effusion as Revealed by Radioscopy.* **Barjon** and **Courmont.** (Archives d'Él. Médicale, 12. p. 869, Nov. 25, 1904. Lyon Médicale, April 3, 1904.)—The upper boundary of an effusion is horizontal or slightly concave in cases in which this boundary is well below the level of the root of the lung, the quantity of fluid being from 200 to 400 cub. cm. When the level of the root is reached the upper limit is represented by a broken line, horizontal to the inner side, then sloping upwards exteriorly. When the effusion reaches above the hilum of the lung the upper limit is an oblique line from above downwards and from without inwards, the inclination varying with the quantity of fluid, which in this case

is from 1,000 to 2,000 c.cm. When the apex of the lung is approached this line becomes almost vertical. Mobility of the fluid with respiration can only be observed when the quantity is very small, and even then it may be absent owing to the diminished mobility of the diaphragm. After the fluid has been aspirated, the upper boundary of the effusion does not alter for some hours, although the re-establishment of the pulmonary functions is often very rapid.
H. W. P. Y.

186. *Therapeutic Value of Radium and Thorium.* **MacLeod.** (Archives d'Él. Médicale, 12. pp. 873–874, Nov. 25, 1904. Brit. Med. Journ., June 11, 1904.)—Cases of lupus vulgaris, lupus erythematosus, rodent ulcer, and two cases of epithelioma of the cervix uteri were treated by exposure to 5 mgm. of bromide of radium contained in sealed glass tubes. The activity of the radium bromide usually employed was 600,000 units, but specimens of double or treble this activity were also used. The use of glass tubes to contain the salt does not diminish the activity of the rays sufficiently to impair their therapeutic action. Each portion of the diseased area is exposed in series, leaving an interval of a week between each series. Great care is taken not to over-expose, as burns are apt to occur which may take several weeks to cure. The action of radium rays, like that of the Röntgen rays, appears to be cumulative. They determine a degeneration of the less resistant cell, and this may proceed to the formation of an indolent ulcer. The rays are of value in small rodent ulcers. Ulcers which have an area larger than a shilling are better treated by Röntgen rays. In cases in which the Röntgen rays seem to have lost their efficiency radium should be tried. Radium is of little use in epitheliomata, but it may prove to be of value in carcinoma of the uterus when associated with surgical treatment. Radium will cure patches of lupus, but is only suitable for small areas. It is of little value in lupus erythematosus. No results were obtained with thorium. H. W. P. Y.

187. *Local and General Action of the Röntgen Rays.* **G. Baermann** and **P. Linser.** (Archives d'Él. Médicale, 12. pp. 869–870, Nov. 25, 1904. Münch. Med. Wochenschr., June 7, 1904. Journ. de Physiol. et de Pathol. Gén., July 15, 1904.)—Contrary to the opinion of Schlotz, who thinks that the Röntgen rays have an elective action on epithelial cells, the authors believe that it is the blood vessels which are primarily influenced, and that the changes in the tissues are a secondary effect. They have examined fragments of tissues which have been exposed to the rays, and have shown that the altered portions correspond to territories supplied by blood vessels which have undergone changes. The red blood cells are not affected, but preserve their property of undergoing hæmolysis under the influence of serums. The latter, it is true, after the action of the rays, lose to a certain degree their hæmolytic power as a result of an alteration of the complements, but this loss of hæmolytic power the authors attribute to heat and not to the rays themselves. The spectrum of the blood remains unchanged. Observations were made as to the nutrition of seven patients undergoing radiotherapy, and it was found that there was an increase in the nitrogenous excretion after each séance, which persisted for two or three days. H. W. P. Y.

REFERENCES.

188. *Electrodynamics of Moving Systems.* **E. Cohn.** (Preuss. Akad. Wiss. Berlin, Sitz. Ber. 46. pp. 1294–1303, Nov. 10, 1904.)—H. A. Lorentz has recently modified the electron theory by new hypotheses. The author of the present paper points out that with these modifications the equations obtained for the electrodynamics of deformed bodies agree with those developed some years ago by himself. E. H. B.

189. *Relation between Electrification Produced by Bubbling Air through Impure Water, and its Electrical Resistance.* **D. Pacini.** (Accad. Lincei, Atti, 13. pp. 617–619, June 4, 1904.)—Employing the apparatus described in his previous paper [see Abstract No. 1997 (1904)], the author has determined the electrification produced by bubbling air through water containing traces of (1) drinking water, (2) sulphuric acid, also measuring the electrical resistance of each solution. Plotting the relation between electrification and resistance, taking the former for abscissæ and the latter for ordinates, the two curves obtained show that the electrification diminishes regularly with fall of the electrical resistance, the decrease being more rapid in the case of water contaminated with sulphuric acid. [See also Abstract No. 2955 (1904).] W. H. Si.

190. *Magnetostriction.* **S. Sano.** (Mathematical and Physical Soc., Tokyo, 2. 14. pp. 175–185, 1904.)—A mathematical *résumé* of the work of F. Koláček, A. Heydweiller, and R. Gans on magnetostriction. [See Abstracts Nos. 334 (1903), 163, 164, 832, 1162, 1163, 2022, 2023 (1904).] E. H. B.

191. *Mechanical Forces Experienced by a Dielectric in an Electromagnetic Field.* **R. Gans.** (Phys. Zeitschr. 5. pp. 627–628, Oct. 15, 1904. Physikal. Inst., Tübingen, Aug. 2, 1904. Reply to F. Koláček's answer.)—The author here defends his position, maintaining that the experiment instanced by Koláček has no effect on Lorentz's theory, and that the calculated effect was due to some error. [See also Abstracts Nos. 1168 and 3271 (1904).] E. H. B.

192. *Electric Dispersion near Thermal Springs.* **A. B. Chauveau.** (Comptes Rendus, 139. pp. 531–533, Oct. 3, 1904.)—At the César spring in Cauterets, Pyrenees, the author found, with the portable Elster-Geitel apparatus which he uses on the Eiffel Tower, an electric dispersion, in the air outside, of + 7·8, – 7·9, and on the gallery above the spring of + 24·4, – 25·7. Reference is made to similar observations by P. Curie and Laborde [see Abstract No. 1651 (1904)]. H. B.

193. *Normal Electric Field of the Earth.* **G. C. Simpson.** (Phys. Zeitschr. 5. pp. 734–736, Nov. 1, 1904. Translation from the English.)—While admitting that the arguments and experiments of Ebert and Endrös [see Abstract No. 3273 (1904)] meet some of his objections, the author points out that Ebert's explanation of the normal earth field would require a daily barometric fall of 17 mm. H. B.

194. *A Source of Ionisation of the Atmosphere.* **J. R. Ashworth.** (Nature, 70. p. 454, Sept. 8, 1904.)—Experiments are described which show that human breath has a considerable power of discharging an electrified conductor. It is suggested that the slow, low-temperature combustion going on in the lungs ionises the air in the same way as the rapid, high-temperature combustion of flames, and that similar effects may occur due to the interaction of the air and living plants, and possibly between the air and inorganic matter at ordinary temperatures. Thus there may be a continual source of atmospheric ionisation apart from radio-active processes. J. J. S

195. *Reception of Radium Emanation by the Human Body.* **J. Elster** and **H. Geitel.** (Phys. Zeitschr. 5. pp. 729–730, Nov. 1, 1904.)—The authors have found, contrary to Ashworth [see preceding Abstract], that the human breath is not ionised generally. Both the breath and the urine of a person who has been working for some hours with radium are found to contain radium emanation. R. S. W.

196. *Saturation Currents in Ionisation.* **G. W. Walker.** (Phil. Mag. 8. pp. 650–659, Nov., 1904.)—In some cases when a gas is ionised no true saturation current is obtained, but the current slowly increases with the field. The author shows that this may be completely explained by the supposition that the plates themselves provide a small supply of ions. R. S. W.

197. *Charge and Discharge of Condenser through Parallel Paths having Resistance and Self-Inductance.* **A. Ekström.** (Svenska Vet.-Ak. Bih. 28. 7. pp. 1–33, 1903.) —A mathematical discussion of this problem, special attention being given to the case in which $r_2 < 4L_2/C$, r_2 and L_2 referring to the resistance and self-inductance respectively of one of the parallel paths. A. H.

198. *Calculation of Current Strength in Network of Conductors.* **W. Feussner.** (Ann. d. Physik, 15. 2. pp. 385–394, Oct., 1904.)—The work begun in an earlier paper [see Abstract No. 933 (1903)] is continued and the equations for the current are further simplified. Various examples, including the Wheatstone's net and the Thomson bridge, are given. S. G. S.

199. *Observations on the Action of the Interrupter.* **K. R. Johnson.** (Phys. Zeitschr. 5. pp. 742–744, Nov. 1, 1904.)—Some effects are noted in the action of an interrupter consisting of two aluminium electrodes in an acidified solution of alum contained in two vessels, one within the other, communicating by means of a small hole in the side of the inner vessel. The circuit was almost inductionless, comprising only the interrupter and a 110-volt storage battery, the current used being 0·5 to 1·0 amp. The distribution of the gases in the interrupter depends on the verticality or otherwise, of the vessel-wall in which the hole is situated. When the wall is vertical the current is soon stopped completely by a bubble of the mixed gases sticking in the hole. The gas mixture was found to be one part oxygen to about five parts hydrogen, oxygen being dissolved in the form of ozone. G. E. A.

200. *The Constitution of Magnets.* **E. Hoppe.** (Phys. Zeitschr. 5. pp. 650–654; Discussion, pp. 654–655, Oct. 20, 1904. Paper read before the 76 Naturforscherversamml. zu Breslau, Sept. 19, 1904.)—Experiments by Hagenbach and Olshausen [see Abstract No. 877 (1901)] have thrown doubt on the applicability of the Biot-Savart law. The author has made some experiments on the field round a rotating magnet. He concludes that we must refuse any theory which would lead us to expect a statical charge on a rotating magnet. Also it appears that the lines of force turn with the turning core, even though the magnetising coil remains fixed. P. E. S.

201. *Reply to Heydweiller on the Villari Critical Point.* **K. Honda** and **S. Shimizu.** (Mathematical and Physical Soc., Tokyo, 2. 13. pp. 173–174, 1904.)— The authors had published work showing that the Villari point in nickel does not exist [see Abstracts Nos. 2022 and 2023 (1904)], to which Heydweiller took exception. The authors now repeat their experiments, using conditions like those in Heydweiller's experiments. They find increase of magnetisation by tension only when the specimen is incompletely demagnetised, and hence on their definition nickel has no Villari point. They attribute Heydweiller's positive result to his not making the specimen magnetically neutral. P. E. S.

202. *Magnetostriction of Ferromagnetic Bodies.* **R. Gans.** (Ann. d. Physik, 15. 2. pp. 418–422, Oct., 1904. Physik. Inst., Tübingen, Sept. 5, 1904.)—A. Heydweiller has replied to the criticism of R. Gans on Heydweiller's paper on this subject [see Abstracts Nos. 1162 and 1163 (1904)]. Gans replies by sending fresh reasoning to establish the correctness of his criticisms. P. E. S.

203. *Magnetic Properties of Ferromagnetics and Alloys.* **K. Honda** and **S. Shimizu.** (Mathematical and Physical Soc., Tokyo, 2. 14. pp. 186–192, 1904.)—The magnetic permeability, hysteresis loss, and magnetic change of length are studied for temperatures between − 186° C. and + 1,200° C. This is in continuation of many previous researches. [See Abstracts Nos. 2022 and 2023 (1904).] P. E. S.

204. *Villari Effect in Nickel.* **A. Heydweiller.** (Ann. d. Physik, 15. 2. pp. 415–417, Oct., 1904. Physik. Inst., Münster, Aug., 1904.)—Honda and Shimizu have criticised the author's work on nickel, and he has replied to them [see Abstracts Nos. 2022 and 2023 (1904)]. He now sends a further reply supporting his own views, viz., that there is a Villari critical point in nickel. P. E. S.

205. *Magnetic Storms, Auroræ, and Sun-spots.* **A. Elvins.** (Electrician, 54. p. 165, Nov. 18, 1904.)—In a lecture delivered before the Canadian Institute, the author expressed the opinion that sun-spots, auroræ, and magnetic storms are all caused by matter forming in space, which, passing sunward in elliptical orbits, would produce auroræ and magnetic disturbances when crossing the earth orbit, and finally falling into the sun further produce sun-spots. The matter would be perturbed by the large planets—hence the eleven years' period—and magnetic storms should be most frequent about the time of the equinoxes. H. B.

206. *Cases of Cancer and Tuberculosis Treated by the Röntgen Rays.* **J. Reboul.** (Archives d'Él. Médicale, 12. pp. 658–669, Sept. 10, 1904.)—A report of five cases of cancer treated by the Röntgen rays. Of these, two cases of skin epithelioma were cured, and some improvement was obtained in two cases of recurrent breast cancer. A case of epithelioma of the tongue appeared to be aggravated, and treatment was abandoned. Healthy cicatrisation was obtained in tuberculous disease of the upper lip, and some improvement in a wrist attacked by tubercle. H. W. P. Y.

207. *Treatment of Pruriginous Affections of the Skin by Radiotherapy.* **J. Belot.** (Archives d'Él. Médicale, 12. pp. 763–770, Oct. 25, 1904.)—The author has treated by radiotherapy the following pruriginous affections of the skin: Pruritus sine materia, pruritus with lichenification, névrodermites circonscrites of Brocq, prurigo, lichen ruber planus, and eczema. He employs rays of small penetrating power corresponding to four or five of Benoist's radio-chronometer, and three or four units according to Holzknecht's scale at a single séance. If necessary the dose is repeated every ten or twelve days. As a rule the pruritus diminished two or three days after the first treatment, often ceasing completely at the end of ten to fifteen days, and secondary lesions, if present, subside and disappear with the exception of pigmentation. Return occurs, but it is the exception. A few cases of lichen planus showed marked improvement. Success has also been obtained with cases of eczema. H. W. P. Y.

208. *Case of Rodent Ulcer Treated by Radiotherapy.* **E. Henrard.** (Archives d'Él. Medicale, 12. pp. 807–809, Nov. 10, 1904.)—The ulcer was situated on the skin of the back and occupied an area of 42 sq. cm. Daily applications of the rays were given for 34 days, at the end of which time cicatrisation had commenced, and two months later the lesion had completely healed. H. W. P. Y.

209. *Treatment of Cutaneous Epithelioma by High-Frequency Sparks.* **H. Bordier.** (Archives d'Él. Médicale, 12. pp. 776–783, Oct. 25, 1904.)—The excitator is in the form of a copper wire mounted in an ebonite handle. This is connected by a chain to the extremity of an Oudin's solenoid. The electrode is approached to the epithelioma to such a distance as will give sparks of from 1 to 2 cm. long. The sparks are allowed to play on the whole area of the growth until the surface begins to become blanched. This result is obtained at the end of 40 to 60 sec. Subsequently a compress is soaked in a weak solution of cyanide of mercury, and after a time the growth becomes replaced by healthy skin, often without any cicatrix. An account of successful cases thus treated is given. H. W. P. Y.

210. *Dangers of Röntgen-ray Treatment for Epithelioma.* **S. M. da Costa** and **T. Passtows.** (Archives d'Él. Médicale, 12. pp. 796–797, Oct. 25, 1904. Medisch. Weekblad voor Noord en Zuidnederland, April 23, 1904.)—The author points out the difficulty of regulating the dosage, since none of the present methods of radiochromometry can be regarded as satisfactory, moreover the sensibility of the skin varies in different subjects. In many cases of epithelioma the disease has not only not been cured, but has undergone rapid extension. He agrees with Oudin, who advises that there should be long intervals in the treatment in order to allow the elimination of the substances produced in the tissues by the action of the rays.
H. W. P. Y.

211. *Treatment of Carcinomata and Epitheliomata by Röntgen Rays.* **H. Guilleminot.** (Archives d'Él. Médicale, 12. pp. 803–806, Nov. 10, 1904. Communication to the Congrès de Grenoble de l'Assoc. Franç. pour l'Avancement des Sciences, Aug., 1904.)—A detailed account of a case of atrophic scirrhus of the breast with ulceration treated by radiotherapy. At the end of twelve séances treatment was discontinued for a time, and shortly after phlegmasia of the right leg supervened, an accident which the author thinks may possibly be due to the result of the rays. The termination of the case was successful. Two unsuccessful cases of cancer of the breast are reported, and one case of rodent ulcer in which a cure was obtained. H. W. P. Y.

212. *New Method of Notation of Electrical Reactions.* **H. Marquès.** (Archives d'Él. Médicale, 12. pp. 828–829, Nov. 10, 1904. Montpellier méd., Feb. 14, 1904.)—A method is described of recording graphically the results of faradic and galvanic testing of muscles and nerves. H. W. P. Y.

213. *Treatment of Lipomata by Röntgen Rays.* **M. Bondet.** (Archives d'Él. Médicale, 12. pp. 833–836, Nov. 10, 1904. Société Nationale de Médicine de Lyon, Séance du 11 Juillet, 1904.)—An account of an unusual case of multiple lipomata accompanied by pain, which, after many different kinds of treatment had been tried without success, improved considerably under radiotherapy, and the concurrent administration of large doses of tincture of iodine. H. W. P. Y.

214. *Phototherapy after Sensibilisation.* **Forschhammer.** (Archives d'Él. Médicale, 12. p. 879, Nov. 25, 1904. Deutsch. Med. Wochenschr., Sept. 15, 1904.)—The author has tested this treatment on 23 cases of lupus, using a 1 per cent. solution of erythrosin. The injections are almost painless at first, but as soon as the exposure to the light begins considerable pain is experienced. The reaction following exposure is very violent, approaching a phlegmon rather than the usual reaction of phototherapy. The therapeutic results are very inferior to those obtained without sensibilisation. Every attempt to regulate the reaction by varying the dosage of the drug or the duration of exposure failed. He considers the method to be of no value. H. W. P. Y.

CHEMICAL PHYSICS AND ELECTRO-CHEMISTRY.

215. *Action of Sulphuryl Chloride on Metallic Oxides.* **E. Spelta.** (Gazzetta Chim. Ital. 34. 1. pp. 262–267, April, 1904.)—Sulphuryl chloride does not react with lead oxide, even at 140–150° in a sealed tube, but with lead peroxide an explosive action often occurs, represented by the equation $2PbO_2 + SO_2Cl_2 = PbSO_4 + PbCl_2 + O_2$. When the sulphuryl chloride is in excess and the mixture becomes heated above its boiling-point, chlorine is also evolved. With mercuric oxide prepared by the dry method, sulphuryl chloride does not react, but with yellow mercuric oxide (2 mols.) it readily reacts at 150° in a sealed tube—$2HgO + SO_2Cl_2 = HgSO_4 + HgCl_2$; if, however, the sulphuryl chloride is in excess, sulphur trioxide is formed—$HgO + SO_2Cl_2 = HgSO_4 + SO_3$. It is hence evident that sulphuryl chloride, which is readily formed from sulphur dioxide and chlorine, is also readily resolved into these components, the change being a reversible one. The chlorinating action of sulphuryl chloride must be due to a slightly stable linking between the sulphur dioxide and chlorine, a linking which must have a special form, since its rupture takes place preferably in presence of electro-positive elements.

T. H. P.

216. *Substitution in the Benzene Nucleus.* **J. J. Blanksma.** (Rec. Trav. Chim. 23. pp. 202–217, May 30, 1904.)—The author has already given it as his view that direct substitution in the benzene nucleus gives rise mainly to the formation of meta-compounds, and indirect substitution to a mixture of ortho- and para-derivatives. The following amplification of this law is generally applicable: If the nucleus contains two or three of any of the groups, NH_2, OH, and CH_3, or any combinations by twos or threes of these groups in the 1-, 3-, and 5-positions, it is possible, under definite conditions, to introduce the groups CH_3, $CH_2.OH$, CH_2Cl, CHO, $CHCl_2$, CO_2H, CCl_3, $CH_3.CO$, $C_6H_5.CO$, HSO_3, I, Br, Cl, NO_2, NO, or $N:NC_6H_5$, &c., and such introduction takes place the more readily the greater the number of Me, NH_2, or OH groups present in the nucleus. Many examples of the application of this rule are given.

T. H. P.

217. *Chemical Action of Radium.* **G. Pellini** and **M. Vaccari.** (Accad. Lincei, Atti, 13. pp. 269–275, Sept. 4, 1904.)—The authors have examined the power of radium radio-activity to promote various chemical reactions which are effected by light and other rays. To prevent the emission of any light rays from the radium, the tube containing it was covered with aluminium foil, and the whole enclosed in another glass tube. This latter tube was found to gradually develop an intense violet colouration after some time. Radium rays are shown to accelerate the decomposition of a 40 per cent. solution of hydriodic acid kept in the dark, and to decompose solutions in chloroform of propyl and isopropyl iodides, which by themselves are stable in the dark. On the other hand, a mixture of equal volumes of a 0·5 per cent. solution of uranyl nitrate and a 2 per cent. solution of oxalic acid, previously saturated in the light with carbon dioxide, is unaffected by the rays, as is also a mixture of 2 parts sodium nitroprussiate, 2 parts ferric chloride, and 10 parts water, no Berlin blue being formed. A careful examination of the effect on a mixture of chlorine and hydrogen shows no combination after 48 hours' exposure to the rays. From these results it is concluded that radium rays have a similar action to the violet and ultra-violet rays, and to the Röntgen rays. A further noteworthy property of radium is its oxidising power, as manifested by the formation of oxides of chlorine and bromine from the radium-barium chloride and bromide respectively, and by the decomposition of iodoform and hydriodic acid. W. H. Si.

218. *Slow Oxidation of Cyanogen and Cyanides by Free Oxygen.* **Berthelot.** (Annal. Chim. Phys. 3. pp. 169–181, Oct., 1904.)—Potassium cyanide in either aqueous or alcoholic solution slowly absorbs oxygen, the rate of absorption increasing with rise of temperature and being greater in sunlight than in the dark. When mercury is present, it dissolves, especially under the action of sunlight. Aqueous hydrocyanic acid also absorbs oxygen to a slight extent. Oxygen is also taken up by cyanogen in either aqueous or alcoholic solution, and the cyanogen rapidly vanishes, its place being taken by carbon dioxide; traces of mercury are dissolved if this metal is present, and light has an accelerating influence on the action. The absorption of oxygen is especially marked in the case of potassium cyanide solution in absence of mercury, whilst hydrocyanic acid alone is only slightly oxidised. T. H. P.

219. *Atomic Weight of Iodine.* **G. P. Baxter.** (Amer. Acad. Proc. 40. 8. pp. 419–436, Oct., 1904.)—From determinations of the ratios Ag : AgI, Ag : I, and AgI : AgCl, the mean value obtained for the atomic weight of iodine is 126·975, the average results from the three different ratios being 126·978, 126·977, and 126·975 respectively. For the first relation a weighed amount of metallic silver, twice reduced from the chloride with sodium hydroxide and invert sugar, then dissolved in nitric acid and deposited electrolytically, was converted into the iodide by addition to its solution in nitric acid of an excess of ammonia and purified ammonium iodide, the silver iodide formed being washed with 1 per cent. nitric acid, and finally with pure water, ignited in a porcelain crucible at a temperature only slightly above its melting-point, and weighed. The second ratio was determined by estimating the exact quantity of a standard solution of silver nitrate required to convert a weighed amount of iodine, in the form of ammonium iodide, into silver iodide; while the third was obtained by heating in a quartz crucible a weighed quantity of silver iodide, exposed to a current of chlorine, and weighing the silver chloride produced. W. H. Si.

220. *Relation of the Hypothesis of Compressible Atoms to Electro-chemistry.* **T. W. Richards.** (Elect. Engin. 34. pp. 528–529, Oct. 7, 1904. Abstract of paper read before the St. Louis International Electrical Congress.)—The author treats first of the relation of compressible atoms to the changes of volume occurring during the formation of solutions of salts from the separate constituents of the salts and water. There is reason to believe that in all cases both the solvent and the dissolved substances change in volume under the readjustment of internal pressures of ionisation, and the resultant effect is so complicated that it is at present impossible, except in the most exaggerated cases, to determine the mode of the distribution of the change. Nevertheless, since changes of volume actually occur on ionisation, and since in the more marked cases this volume-change seems to correspond roughly with the known compressibilities of the substances and with the free-energy charge

during the reaction, support is given to the theory of compressible atoms. Another relation of this theory to electro-chemistry is found in the effect of change of volume of reacting systems upon their specific heats, from which it is deduced that the fundamental cause of the temperature-coefficient of the e.m.f. of a cell is to be found in atomic compression and distortion, which diminish the possibility of heat vibration in the compressible atom. The relation of ionisation to the quantity dimension of electricity is also discussed.

T. H. P.

221. *Viscosity of Liquid Mixtures.* **A. E. Dunstan.** (Zeitschr. Phys. Chem. 49. pp. 590–596, Oct. 7, 1904.)—Plotting viscosity against composition, the following mixtures exhibit a maximum, minimum, or no singularity :—

Maximum.	Minimum.	No Singularity.
Water—Acetic acid.	Alcohol—Benzaldehyde.	Alcohol—Acetone.
Water—Methyl alcohol.	Alcohol—Benzol.	Alcohol—Carbon disulphide.
Water—Ethyl alcohol.		Alcohol—Ethyl mercaptan.
		Ethyl acetate—Benzol.

The author appears to attribute the existence of "anomalies" to the presence of a pronounced chemical affinity, and ascribes the abnormal increase of viscosity in some of these mixtures to the formation of high molecular complexes.

F. G. D.

222. *Graphic Representation of the Properties of Elements by Characteristic Surfaces.* **G. Martin.** (Chem. News, 90. pp. 175–177, Oct. 7, 1904.)—A method is suggested for quantitatively portraying all the chemical properties of each element by a geometrical figure. The periodic system is plotted on a flat surface as base, and for any given element perpendiculars are drawn from every point of the base proportional to the attractive force this element exerts on that represented by the point. A surface drawn through the summits of these perpendiculars is called the characteristic surface of the element, and can be expressed by an equation in three variables, from which all the different affinities of the element can be deduced. To each different valency state there corresponds a different affinity surface, but the author finds that by a simple artifice, even assuming for each element every grade of valency between 1 and 8, the total number of surfaces can be reduced to 64. The complete theory of these surfaces will shortly be published in a memoir, but the following results are now given, deduced from the affinity surfaces obtained by regarding all the elements in that valency state in which, under ordinary conditions, they attain greatest chemical equilibrium: (1) The affinity surfaces of chemically similar elements have a similar shape, those of dissimilar elements different shapes; (2) the form of the surface for a metal is diametrically opposite to that of a non-metal, those of Li, Na, and K being almost exact mirror-images of those of F, Cl, and Br; (3) the view of the chemical inactivity of nitrogen is not entirely correct, this element forming with B, Si, and P compounds of great stability; (4) the affinity surface for hydrogen shows it to belong to the alkali metal group, and not to the halogens; and (5) the point of maximum affinity moves from F to Li as one passes from Li to F. Since the chemical properties of elements depend upon their attractive forces, the latter must necessarily go through cycles with rising atomic weight, in accordance with the periodic law. This is well shown by the characteristic surfaces, which when arranged in order of their

atomic weights assume the appearance of successive positions of an advancing wave surface whose crest, entering the field of view at the extreme right of the diagram, gradually sweeps across to the left and passes out of view.

W. H. Si.

223. *Changes Induced in Properties of Elements by Altered External Conditions.* **G. Martin.** (Chem. News, 90. pp. 189–192, Oct. 14, 1904.)—By viewing different elements at suitable temperatures they can be made to more closely resemble each other in chemical properties. Thus sulphur at 1,000° becomes more like oxygen at ordinary temperatures, while oxygen at low temperatures would probably assume the normal condition of sulphur. Fluorine at ordinary temperatures is comparable with chlorine at about 180° and bromine at a still higher temperature, and water at 200–300° reacts with metals with evolution of hydrogen, similarly to the halogen acids, at lower temperatures. In all these cases the conditions which bring the chemical properties closer together also render the elements physically more alike. From such considerations the author suggests that the properties presented by any element at ordinary temperatures are only particular phases which can be assumed by other elements under other and as yet unknown external conditions, involving probably temperature, electric field, pressure, and medium. Applying this theory to the periodic system, it is conceivable that the elements might all be made chemically similar, thus avoiding any groups and series, or the conditions might be so chosen as to produce a continual and progressive alteration of properties of the elements, thus getting rid of any periodic relation whatever. Finally, the periodic law may be regarded as a particular case of a wider and probably very simple law. W. H. Si.

224. *Density of Nitrous Oxide, and Atomic Weight of Nitrogen.* **P. A. Guye** and **A. Pintza.** (Comptes Rendus, 139. pp. 677–679, Oct. 31, 1904.)—The density of nitrous oxide has been determined by connecting a large globe of known volume, filled with the gas, to a condensing tube containing well-washed carbon, a manometer being also attached to the globe to measure the pressure of the gas left in it after absorption. Towards the end condensation is facilitated by surrounding the tube with a mixture of solid carbon dioxide and ether, after which the tube is disconnected and weighed, whence the weight of 1 litre of nitrous oxide at 0° C., under 1 atmosphere at sea-level, latitude 45°, is found to be 1·97788 gm., which is not materially different to that given by previous investigators. Comparing the density of nitrous oxide with that of carbon dioxide, taking the weight of 1 litre of the latter as 1·97693, and the atomic weight of carbon as 12·005, the value 14·013 is deduced for the atomic weight of nitrogen. It is concluded that the atomic weight of nitrogen is at the most 14·02. W. H. Si.

225. *Stereochemistry of Nitrogen.* **H. O. Jones.** (Chem. News, 90. pp. 193–194, Oct. 14, 1904. Abstract of paper read before the British Association at Cambridge.)—A digest of the original paper, which contains a summary of past work in all branches of the subject. The plane configuration of tervalent nitrogen compounds, to be expected from dynamical considerations, is supported by failure to obtain such compounds optically active, and by the homogeneity of the substituted acid amides produced by the interaction of an acid chloride containing an asymmetric carbon with various amines, showing that the nitrogen does not form a centre of asymmetry. Hantzsch and Werner's hypothesis, which assumes two positions of equilibrium for the group attached to the third valency in compounds containing a nitrogen atom joined by a double union to another atom, alone satisfactorily explains the isomerism of substances of the type $^{a}_{b}{>}C=N-c$. The isomerism of quinquivalent nitrogen compounds is fully considered. Of the three types, $N.a_3bX$, $N.a_2bcX$, and $N.abcdX$, where a, b, c, d represent monovalent atoms or groups and X the acidic radical, the two former are apparently incapable of optical activity, but the last can be resolved into optical antimers. The three principal configurations proposed, viz., the "cubic" of van't Hoff, the "double tetrahedral" of Willgerodt, and the "pyramidal" of Bischoff, are discussed, the last being considered to best account for all the known facts, if it be assumed that during the addition of *d*X or HX to an amine, the acidic radical X takes up a position at the base of the pyramid, and is then capable of changing positions with the radical at the apex. W. H. Si.

226. *Isohexanes in Roumanian Petroleum.* **P. Poni** and **N. Costachesco.** (Annales Scientifiques de l'Univ. de Jassy, 3. pp. 95–102, Nov., 1904.)—The authors have used a Young fractionating column to rectify certain fractions (from 57·5–64·5°) of Roumanian petroleum, and then studied the action of nitric acid on the fractions so as to ascertain the nature of the isohexanes from an examination of the resulting nitro products. Experiments were first made with nitric acids of different concentration acting under pressure, and from the results obtained the authors infer that the fractions collected between 59·5° and 64·5° are mixtures of 2-methylpentane and 3-methylpentane; nitric acid of 1·4 density, when acting under pressure on such mixtures, attacks first the 3-methylpentane, and hence allows of the isolation of pure 2-methylpentane. In this action there is not formed either solid trinitro derivative or oxyacid. To obtain the trinitro derivatives fuming nitric acid is necessary. D. H. J.

227. *Oxidation of Acetol.* **A. Kling.** (Comptes Rendus, 139. pp. 740–742, Nov. 7, 1904.)—The author has examined the effect of numerous oxidising agents on acetol, and arranges them in three classes according to the results obtained. The first, comprising $Cu(OH)_2$, $Fe_2(OH)_6$, $Hg(OH)_2$, $K_6Fe(CN)_6 + KOH$, and manganese hydrates, give lactic acid as the chief product, together with small quantities of aldehyde and formic acid, oxidation taking place in neutral or alkaline aqueous solution. The second includes $HgCl_2$, $(CH_3CO_2)_2Cu$, and other salts, susceptible on boiling with water of forming basic salts, which produce only a very small amount of lactic acid, while the third consists of strong oxidising agents, such as H_2CrO_4, PbO_2, HNO_3, Na_2O_2, $KMnO_4$, H_2O_2, AgOH, and $H_2SO_4 + HgSO_4$, which are chiefly acid or monobasic in character, and which give no lactic acid at all, the products of oxidation being acetic and formic acids or carbon dioxide. By the addition of $Ba(OH)_2$ or $Ca(OH)_2$ to the acetol solution, acetolates were obtained, and the author concludes that the difference in effect of the various oxidising agents is due to the possible formation in some cases of intermediate hydrated bodies, and not, as suggested by Nef, to the medium in which the compounds act. W. H. Si

228. *Yttrium and Ytterbium occurring in Fluor-Spar.* **W. J. Humphreys.** (Astrophys. Journ. 20. pp. 266–273, Nov., 1904. Phys. Rev. 19. p. 300, Oct., 1904. Abstract of paper read before the Amer. Physical Soc., St. Louis, Sept. 16,

1904.)—Samples of fluor-spar obtained from Amelia Court House, Virginia, were found to contain quite appreciable amounts of yttrium and ytterbium, and it was considered of sufficient importance to suggest the examination of an extensive series of specimens of fluor-spar from widely-separated localities, those instanced being from Africa, America, Asia, Australia, and Europe. Most of the samples contained yttrium in varying quantities, and many small amounts of ytterbium. Along with the fluor spar at Amelia Court House occur several other minerals, and of these allanite, beryl, columbite, feldspar, garnet, microlite, and monazite were examined. Yttrium was found in them all, and as with the fluor-spars, where the yttrium was in quantity, ytterbium was also detected. The samples richest in ytterbium and yttrium were found to be also exceptionally sensitive to thermal effects, and although this may only be a coincidence, it would appear to favour the probability that the phosphorescence is conditioned by some sort of molecular instability. There appears to be no connection between the amounts of yttrium and ytterbium present and the colour or transparency of the fluor-spar. This apparently wide distribution of these two rare elements prepares the way of searching for them in the solar spectrum, and in addition to those previously mentioned by Rowland, the author gives a list of nine lines of yttrium and four lines of ytterbrium which he has satisfactorily settled to be present in the solar spectrum. C. P. B.

229. *Preparation of Aurous Iodide by the Action of Iodine on Gold.* **F. Meyer.** (Comptes Rendus, 139. pp. 733–736, Nov. 7, **1904.)**—At the ordinary temperature, pure, dry iodine has no action on gold, while aurous iodide is undecomposable in a vacuum. Between 50° and the fusing-point of iodine the latter combines with gold, giving amorphous aurous iodide, whilst at higher temperatures the crystalline iodide is obtained. The reaction is always limited by the inverse decomposition of the iodide, but the presence of excess of iodine ensures the formation of the pure iodide. The best means of removing the excess of iodine from the iodide is to heat the mixture to about 30°, since most solvents of iodine decompose the iodide. In a closed vessel, and in presence of water, iodine and gold form this same iodide, but here also the action is a limited one and even at the ordinary temperature, if the iodine is allowed to escape, the iodide undergoes complete decomposition under the action of water or moist air. T. H. P.

230. *Influence of Certain Substances on the Formation of Rust.* **L. Lindet.** (Comptes Rendus, 139. pp. 859–862, Nov. 21, **1904.)**—The presence of copper in water in contact with iron is shown to considerably favour the production of iron oxide, while tin, zinc, lead, manganese, aluminium, and magnesium retard it. Water which has stood in contact with these metals for some time has the same effect as the metals themselves, the results evidently being due to solution of traces of hydrated oxides. Iron oxide promotes the formation of rust, which spreads very rapidly once it has appeared. Arsenic has a distinct retarding influence, and in sufficient quantity prevents it altogether, ferrous arsenite, which is first formed, being oxidised to the ferric salt, containing only about one-third the amount of ferric oxide obtained under ordinary conditions. Arsenic acid and arsenic trisulphide (orpiment) completely prevent oxidation, but the chlorides and sulphates of sodium, potassium, and ammonium, owing to electrolytic dissociation, render it two or three times more rapid. Of organic bodies, sugar, phenol, and resorcinol accelerate rusting, while alcohol and methyl salicylate inhibit it, acetic and salicylic acids dissolving the iron oxide as it is formed. The author considers the rusting of tinned or galvanised iron cans containing methylated spirit for motor purposes, to be due chiefly to the light coal-tar naphtha, present to the extent of some 50 per cent., which has a powerful oxidising influence; but although methyl and ethyl acetates do not themselves favour oxidation, the acetates formed by their action on zinc, tin, and iron contribute thereto, especially in presence of benzene. W. H. Si.

231. *Gelatinisation. Internal Friction of Colloidal Solutions.* **S. A. Levites.** (Jurn. Russk. Fisik. Chimičesk. Obščestva, 36. pp. 401–417, April 26, 1904.)—The author gives the results of an investigation on the relation between the changes brought about in (1) the velocity of coagulation of solutions of glutin, agar-agar, albumin and casein (in alkali) by the addition to them of various substances, and (2) the internal friction of the solutions. The following conclusions are drawn: Colloidal solutions may be regarded as solutions, inasmuch as they consist of homogeneous mixtures of a liquid and a solid phase. Among solutions of colloids, those of organic colloids are most nearly allied to actual solutions; metallic hydrosols are most likely pseudo solutions. A jelly consists of a mixture of a solid and a liquid phase. Gelatinisation does not take place simultaneously with the attainment of equilibrium between these two phases, which only sets in very gradually after gelatinisation. The speed of gelatinisation in presence of a foreign substance depends on the influence exerted by that substance on the solubility of the colloid in question. The influence exerted by a foreign (crystalloid) substance on the internal friction of a colloidal solution depends on the influence of the substance on the internal friction of the solvent, but is independent of the nature of the colloid. More complex results are obtained when two or more colloids are present in one and the same solution. T. H. P.

232. *Velocities of the Ions in Liquid Ammonia Solutions.* **E. C. Franklin** and **H. P. Cady.** (Amer. Chem. Soc., Journ. 26. pp. 499–530, May, 1904.)—A form of apparatus is described which permits of the application of Masson's method [see Abstract No. 258 (1900)] to the measurement of the absolute velocities of ions in liquid ammonia. Measurements made with ammonium, potassium, sodium and silver nitrates, and sodium chloride show that the absolute velocities of monovalent ions in liquid ammonia at —33° are from 2·4 to 2·8 times as great as in aqueous solutions at 18°; the values obtained are in agreement with the velocities calculated from conductivity measurements by Kohlrausch's method. Although the dissociating power of liquid ammonia is comparatively low, the velocity of migration of the ions is remarkably high. With ammonium and potassium nitrates, sodium chloride and bromide, the speeds of the ions are independent of the degree of dilution, but in the cases of ammonium chloride and bromide there is a rapid increase in the transport number of the ion as the concentration increases; ammonium iodide behaves similarly, but the increase is here less marked. T. H. P.

233. *Study of Hydrolysis by Conductivity Methods.* **J. Stieglitz** and **I. H. Derby.** (Amer. Chem. Journ. 31. pp. 449–458, May 15, 1904.)—Although the catalysis of methyl acetate furnishes the most accurate method for the measurement of the hydrolysis of hydrochlorides of weak bases, the method of conductivity measurements has the advantage of being the most rapid to execute, and is therefore indispensable in cases where the course of a progressive hydrolysis is to be followed [see Stieglitz and Upson, next Abstract]. The percentage of salt x which has undergone hydrolysis can be calculated from the observed molecular conductivity M_v, by means of the equation: $x = (M_v - \mu_v)/(\mu_{HCl} - \mu_v)$, where μ_v and μ_{HCl} represent the conductivities of the non-hydrolysed salt and the free acid respectively. Various interpretations have been given to the magnitude of μ_{HCl} in this equation. Conductivity measurements of mixtures of potassium chloride and hydrochloric acid show that the actual relations are most nearly in accord with the views of Walker, according to which μ_{HCl} represents the molecular conductivity of the acid for the original concentration of the salt solution, *i.e.*, for a completely hydrolysed salt. Further confirmation of Walker's view is given by measurements of solutions of aniline hydrochloride containing varying excesses of hydrochloric acid. Calculating the amount of free acid, on the one hand, from the known affinity constants of aniline and the dissociation constant of water, and on the other, from the conductivity determinations by Walker's method, complete agreement is obtained. T. H. P.

234. *Molecular Rearrangement of Aminophenyl Alkyl Carbonates.* **J. Stieglitz and H. T. Upson.** (Amer. Chem. Journ. 31. pp. 458–502, May 17, 1904.)—The authors find that each of 12 orthoaminophenyl alkyl carbonates examined by them exhibits a tendency to change into its corresponding urethane, and in every case the hydrochloride of an amine can be isolated. The following are the affinity constants, K_{aff}, and velocity constants of rearrangement k, found by determining the conductivity of the hydrochlorides at 0° by the method of Stieglitz and Derby [see preceding Abstract]:

	K	$K_{aff} \times 10^{14}$	k
4-Aminophenyl methyl carbonate	23200	27800	—
4- „ ethyl „	22050	26500	—
2- „ methyl „	1040	1250	0·1017
2- „ ethyl „	800	960	0·0578
2-Amino-4-methylphenyl ethyl carbonate	1020	1225	0·0186
2- „ -5- „ „ „	1800	2160	0·0717
2- „ -6- „ „ „	880	1050	0·0659

(The affinity constant of the base is K × the degree of dissociation of water, $1{\cdot}2 \times 10^{-14}$; $K_{aff} = K \times 1{\cdot}2 \times 10^{-14}$). These numbers show that the ortho-aminophenyl alkyl carbonates are, without exception, much weaker bases than the corresponding para-derivatives, and their affinity constants are only about 1,000 times the dissociation constant of water. This agrees with observations made by Ostwald and other authors on the influence of negative groups in the *o*- and *p*- positions on the affinity constants. Of the three cresol derivatives, the base with the methyl-group in the para-position to the amino-group is stronger than the isomeric base with the same group in the meta-position. The coefficients of rearrangement are moderately high, and if the whole of the base existed free in the solution from the beginning, about 90 per cent. of it would undergo change in from 40 to 120 min. A study of the arrangement of a number of halogen derivatives of the *o*-aminophenyl alkyl carbonates shows that a methyl group in position 4 delays the change, both with the non-substituted compounds and with the halogen derivatives. A methyl group in position 6 retards the rearrangement somewhat at 25°, but accelerates it slightly at 0°. A halogen atom in the 6-position always conditions a great increase in the velocity compared with a halogen in position 4. The substitution of a halogen atom for hydrogen in the 4-position has a retarding influence. Here, too, there exists no relation between the weakness of the base and the velocity of rearrangement. The rearrangement in the solutions of the salts of the halogen derivatives, as in the case of the unsubstituted compounds, is entirely dependent on the presence of the free base. T. H. P.

235. *Ferment Action.* **L. Liebermann.** (Ber. Deut. Chem. Gesell. 37. pp. 1519–1524, May 7, 1904.)—Colloidal platinum solutions contain active oxygen, the source of which is possibly the molecular oxygen of the air. Under the action of gaseous hydrogen or nitrogen the quantity of active oxygen diminishes, while at the same time the brownish colour of the solution changes to blackish-brown. Under certain conditions the passage of nitrogen through the solution increases its activity, probably by increasing the number of platinum particles. Extremely dilute solutions (0·006 — 0·008 gm. platinum per 100 ccm.) may be boiled for half an hour without destroying their power to become active again on standing in an atmosphere of oxygen or air. The author concludes that this active oxygen plays an important part in catalysis, as it gives a start to the reaction, of which it represents the initial phase. The true ferments of organic origin never contain active oxygen, but generally possess the power of taking up active oxygen (ozone) and of fixing it for a short time. At high temperatures oxygen has an injurious action on all ferments, the temperature at which the latter are destroyed being lower in an atmosphere of oxygen than in air or an oxygen-free medium. These ferments differ in the mechanism of their action from that of the catalysis of hydrogen peroxide by colloidal metal solutions, inasmuch as a direct action of the enzyme on the peroxide takes place, possibly with the intermediate formation of an oxide or peroxide of the ferment. T. H. P.

236. *Basic Properties of Cacodylic Acid and of Urea.* **J. v. Zawidski.** (Ber. Deut. Chem. Gesell. 37. pp. 2289–2298, May 20, 1904.)—Cacodylic acid has a dissociation constant, $K = 4·2 \times 10^{-7}$, which is very near to that of carbonic acid, namely, $K = 3·04 \times 10^{-7}$. On mixing solutions of potassium hydrogen carbonate and potassium hydroxide, the electrical conductivity is 56·4 per cent. less than the additive value, whilst with sodium cacodylate the diminution is only 10 per cent., with sodium chloride 4 per cent., and with sodium acetate 5·5 per cent. From this difference between the behaviour of carbonic and cacodylic acids, it is concluded that the latter has no dibasic tendency. The dissociation constant of cacodylic acid as a base is calculated from its accelerating effect on the bi-rotation of lactose to be $1·35 \times 10^{-13}$, a number which agrees with the values calculated from the hydrolysis of its hydrochloride and from its influence on the bi-rotation of dextrose. The dissociation constants for urea obtained in these ways are also in agreement. [See also Abstract No. 2408 (1904).] T. H. P.

237. *Reduction of Nitrates by Plant Extracts and Metals.* **J. H. Kastle** and **E. Elvove.** (Amer. Chem. Journ. 31. pp. 606–641, June, 1904.)—Of a large number of aqueous plant extracts examined, it is found that those of the tubers and sprouts of the potato and of the fruit of the egg plant (*Solanum melongena*) are the only ones capable of reducing sodium nitrate to nitrite. This reducing power is most active at 40–45° and is destroyed by boiling. A large number of substances inhibit the action, others greatly weaken it, whilst some accelerate it. Platinum black, prepared by precipitating the metal from its chloride by zinc dust and well washing the deposit with hydrochloric acid and water and drying, is also able to reduce sodium and potassium nitrates to nitrites, the amount of the latter obtained being greatly increased by the presence of such substances as ethyl alcohol, formaldehyde and formic acid. When heated the activity of the platinum black increases, and if kept at 300° for half an hour it becomes very active. It is found that this reducing action of platinum black is due to the presence of zinc as an impurity; platinum black prepared in other ways exhibits no such action. Pure precipitated silver is totally inactive towards potassium nitrate even in presence of an accelerator, whilst silver-zinc alloy, obtained by immersing zinc in silver nitrate solution, possesses considerable reducing power, especially in presence of certain other substances, for instance, formaldehyde. T. H. P.

238. *Determination of Solubility of Salts of Weak Acids by Measurements of Conductivity.* **D. Gardner** and **D. Gerassimoff.** (Zeitschr. Phys. Chem. 48. pp. 359-364, June 7, 1904.)—The method of determining solubility from measurements of electrical conductivity is only valid when no hydrolysis of the salt takes place. Thus the conductivity of a saturated solution of barium carbonate is given by Kohlrausch as 25·5 × 10^{-6}, but a considerable part of this conductivity may be attributed to the presence of the products of hydrolysis. $2BaCO_3 + 2H_2O = BaH_2(CO_3)_2 + Ba(OH)_2$. To test this the authors determined the solubility of barium carbonate in presence of small quantities of sodium hydroxide, which would have the effect of repressing the hydrolysis, and obtained the following results :—

Conductivity of Dilute Soda.	Additional Conductivity due to Barium Carbonate.
—	28·6 × 10^{-6}
14·5 × 10^{-6}	23·6
69	15·9
117·5	13·3
128	12·1
222	9·9
376	8·8
629·5	6·7

The limiting value would be about 6·0, less than one-fourth of that obtained when water alone was used as the solvent. T. M. L.

239. *Catalytic Production of Sulphur Trioxide.* **G. Lunge** and **K. Reinhardt.** (Zeitschr. Angew. Chemie, 17. pp. 1041-1051, July 29, 1904.)—The authors have extended the work of Lunge and Pollitt, using an electric resistance furnace to heat the tube containing the contact substance. It was found that with pure ferric oxide catalytic action begins about 400° C., and reaches its maximum at 625° C. in converting SO_2 and air. Drying the gases by P_2O_5 instead of by ordinary H_2SO_4 is practically without influence on the result. When the burnt pyrites was impregnated with As_2O_3 the results in the most favourable case were practically the same as those with ferric oxide alone. Pure ferric arsenate gave the same maximum conversion as ferric oxide. Pure As_2O_5 acts as a strong catalyst. Silica has a very perceptible action. W. W. H. G.

240. *Coagulation of Suspensions or Colloids and Bacterial Agglutination.* **H. Bechhold.** (Zeitschr. Phys. Chem. 48. pp 385–423, June 21, 1904. From the K. Preuss. Inst. für experimentelle Therapie zu Frankfurt a/M.)—Coagulation is a gradual process, the rate at which it proceeds depending on the concentration of the suspension and of the electrolyte. Below a certain concentration of electrolyte or suspension, there is practically no coagulation, whilst above a certain concentration of electrolyte no further increase in velocity occurs. There is no substantial difference between the coagulation of inorganic suspensions or colloids and of bacteria. The aggregation of bacteria, like that of suspensions which travel towards the anode, is dependent on the valency of the kathion, its migration-velocity, its decomposition-potential, and the electrolytic dissociation of the electrolyte, but bacteria are not influenced by mono- and di-valent kathions with a high decomposition potential.

T. M. L.

241. *Catalytic Action of Metallic Chlorides.* **H. Goldschmidt** and **H. Larsen.** (Zeitschr. Phys. Chem. 48. pp. 424–434, June 21, 1904. Chem. Laborat. der Univ., Christiania.)—The examples studied were (1) the chlorination of nitrobenzene in presence of stannic and aluminium chlorides, and (2) the Friedel Crafts reaction in presence of aluminium chloride. In the interaction of benzyl chloride with an excess of anisol, the catalytic action of the aluminium chloride is proportional to its concentration, and the velocity of change is given by the formula $dx/dt = K(a - x)C_{AlCl_3}$, where a is the initial concentration of the benzyl chloride. The velocity constant is nearly doubled by a rise of 10° C. in temperature. Similar conditions probably govern the interaction of acid chlorides with hydrocarbons in presence of aluminium chloride, but the action is complicated by the combination of the resultant ketone with the aluminium chloride, which thus ceases to act as a catalyst. T. M. L.

242. *Hydrates of Nitric Acid.* **F. W. Küster** and **R. Kremann.** (Zeitschr. Anorg. Chem. 41. 1. pp. 1–42, Aug., 1904. Laborat. der Bergakademie, Clausthal, Sept., 1903, and June, 1904.)—The present paper is a reply to H. Erdmann, who states that orthonitric acid, $N(OH)_5$, and other similar compounds of nitric acid exist, and that orthonitric acid, containing 63·63 per cent. of nitric acid, evaporates unchanged at −15°. The authors give the results of some fifty experiments made on the evaporation in a current of air at −15°, of acids containing from 61·76 to 77·78 per cent. of nitric acid, under a pressure of 60 cm. Under these conditions an acid containing 63·64 per cent. of nitric acid yields a distillate containing only 54 per cent. of acid. When the proportion of nitric acid is 66·1 per cent., the distillate has the same strength, whilst distillates from more concentrated acids contain still higher proportions of nitric acid than those distilled. Erdmann's statement that the high viscosity possessed by the compound $O\{N(OH)_4\}_2$ agrees with its high molecular weight is questioned, it being pointed out that conclusions as to molecular weights cannot be deduced from the values of their viscosity constants. Experiment shows that the greatest viscosity coefficient at +15° and −15° is possessed by an acid containing 65 per cent. and not 70 per cent. of nitric acid, as is required by Erdmann's supposed compound. The latter author gives −39° as the melting-point of the compound $O\{N(OH)_4\}_2$; acid of this composition does not show a well-defined melting-point, as the crystals which separate at −39° have the composition $HNO_3, 3H_2O$, and melt at −19° after removal from the mother liquor. The complete freezing-point curve for mixtures of nitric acid and water has been constructed from measurements made in a Beckmann apparatus with a nickel-iron thermo-element and a Deprez-d'Arsonval galvanometer. This curve indicates that nitric acid yields two hydrates, $HNO_3, 3H_2O$ and HNO_3, H_2O, containing respectively 53·84 and 77·77 per cent. of acid. There are three minima to the curve, pointing to the existence of three cryohydrates: At −43°, ice and $HNO_3, 3H_2O$; at −42°, $HNO_3, 3H_2O$ and HNO_3, H_2O, and at −66°, HNO_3, H_2O and HNO_3. Erdmann's views are not confirmed by the conductivity curves, which do not exhibit minima at the positions corresponding with the compounds supposed by this author to exist. Similar results are obtained by dilatometric measurements. The maxima in the curve of solidification temperatures exhibit flattening, indicating dissociation of the compounds. The degree of dissociation may be arrived at by comparing the lowering of freezing-point produced by the addition of one of the components with that given by the addition of a foreign substance. The results of such comparison are given for the monohydrate, HNO_3, H_2O, which dissociates thus: $HNO_3, H_2O \rightleftarrows HNO_3 + H_2O$. [See also Abstract No. 2437 (1904).] T. H. P.

243. *Chlorostannic Acid.* **I. Bellucci** and **N. Parravano.** (Accad. Lincei, Atti, 13. pp. 307–314, Sept. 18, 1904.)—Chlorostannic acid placed in a vacuum in the presence of potassium hydroxide is found after 12 days to be completely reduced to stannic chloride, small crystals of $SnCl_4 . 5H_2O$ being produced after some time. No compound analogous to pentachloroplatinic acid is apparently formed. When titrated with sodium hydrate, using phenolphthalein as indicator, a red colour is not produced until six equivalents of alkali have been added, whereas chloroplatinic acid functions under these conditions as a dibasic acid. An attempt to titrate chlorostannic acid by Kohlrausch's method, in which the electrical resistance serves as indicator, proved unsuccessful, the fall in conductivity proceeding quite regularly till 2·133 molecules NaOH had been added per molecule $SnCl_6H_2$, after which the solution showed distinct hydrolysis. With chloroplatinic acid, on the contrary, the conductivity diminishes regularly till two molecules NaOH have been added per molecule $PtCl_6H_2$, and then rises again. The contrast between the stability of the two acids is also manifested by their salts. W. H. Si.

244. *Velocity of Reaction between* HI *and* HIO_3. **S. Dushman.** (Journ. Phys. Chem. 8. pp. 453–482, Oct., 1904.)—The experiments were carried out according to the method of having all the substances except one in such excess that their concentrations remain practically constant during each experiment. This method was not available in the case of hydrogen ions owing to the great increase of speed produced by an excess of this substance. This difficulty was surmounted by employing a mixture of acetic acid and sodium acetate, whereby the concentration of the hydrogen ions could not only be kept constant in any reaction, but varied in a determinate and calculable manner from one experiment to another. All the solutions were freed from oxygen and preserved in an atmosphere of CO_2, and every precaution was taken to avoid the entrance of oxygen during the measurements. The reaction was stopped by adding ammonium bicarbonate, and the iodine set free was titrated by centinormal arsenite and iodine solutions with starch as indicator. In solutions not containing excess of free iodine (*i.e.*, I_3 ions) the velocity equation is, $v = KC_{IO_3} . C_I^{1 \cdot 9} . C_H^2$. In the presence of excess of tri-iodide another simultaneous reaction occurs, the velocity being represented by the equation, $v = KC_{IO_3} . C_I^{1 \cdot 9} . C_H^2 + R . C_{IO_3} . C_I . C_{I_3} . C_H^2$, where K and R denote the constant velocity coefficients of the two reactions. These results were obtained from solutions containing potassium iodide, potassium iodate, sodium acetate, acetic acid, and iodine (in the second series). Experiments carried out in solutions made up with free hydriodic and iodic acids, with or without an excess of free iodine, confirmed the foregoing velocity-equations, although the absolute values of the velocity coefficients were not found to agree with those obtained in the acetic acid and acetate solutions. With regard to catalysers, light was not found to exert any appreciable action. Neither did $K_2Cr_2O_7$ affect the speed, although $FeSO_4$ produced a moderate acceleration. The author expresses himself very guardedly with respect to a molecular interpretation of the results. It is suggested that the reaction (in the absence of I_3 ions) may be, $2\overset{-}{I} + 2\overset{+}{H} + \overset{-}{IO_3} = 2HOI + \overset{-}{IO}$, *i.e.*, the hydriodic acid is oxidised to hypoiodous acid, whilst the iodate ion is reduced to the hypoiodite ion. In the case where I_3 ions take part in the reaction, the author suggests the equation, $\overset{-}{I} + \overset{-}{I_3} + 2\overset{+}{H} + \overset{-}{IO_3} = HOI + HOI_2 + \overset{-}{IO}$, where it must be supposed that the substance HOI_2 enjoys only a very transient existence, breaking up into IOH and I_2. F. G. D.

245. *Alloys of Zinc and Magnesium.* **O. Boudouard.** (Soc. d'Encouragement, 106. Rev. de Metallurgie, pp. 545–547, Oct., 1904.)—The fusibility curve of these alloys shows one maximum and two minima; the maximum corresponds to the definite compound Zn_2Mg, and microscopic evidence shows the existence of another definite compound, $ZnMg_4$. The latter appears on polished sections of the ingots of alloy with 50 per cent. Zn as a fine dendritic crystallisation. When an ingot of 80 per cent. Zn and 20 per cent. Mg is attacked with a 0·3 per cent. solution of hydrochloric acid in the cold for several days, a powder is left which has the chemical composition corresponding to the formula Zn_2Mg. The compound $ZnMg_4$ is best isolated by attacking an ingot of 70Mg, 30Zn with a warm 0·5 per cent. solution of ammonium chloride for several hours; a metallic powder remains whose composition corresponds to that of the formula given above. All these alloys are difficult to polish; they are all white in colour, and that with 10 per cent. Zn can be readily filed and sawn; with higher contents of Zn the alloys become extremely brittle and even friable. W. Ros.

246. *Decomposition and Synthesis of Ammonia.* **E. P. Perman.** (Chem. News, 90. p. 182, Oct. 7, 1904. Paper read before the British Association, at Cambridge.)—The passage of a mixture of nitrogen and hydrogen (1:3) through a red-hot glass tube into dilute acid, subsequently rendered alkaline, and tested with Nessler solution, fails to show the slightest trace of ammonia, as also results when the tube is packed with broken porcelain. If, however, the mixture is passed over red-hot iron or many other metals, or over asbestos, pumice, or clay tobacco-pipe stems, traces of ammonia are formed. The last-named substances contain iron, and it is concluded that the presence of some catalytic agent is essential for any combination to take place. Traces of ammonia are produced by sparking a mixture of nitrogen and hydrogen, equilibrium being established in about 30 min., and approximately the same

equilibrium-point is reached when ammonia is decomposed by sparking, but only after many hours, if the volume is kept constant. These results, together with those already obtained by heating ammonia in a porcelain globe [see Abstract No. 2923 (1904)] are considered to disprove the existence of any equilibrium in the case at all. W. H. St.

247. *Measurements and Calculations on the Equilibria of Highly Dissociated Acids.* **K. Drucker.** (Zeitschr. Phys. Chem. 49. pp. 563–589, Oct. 7, 1904.)—This paper consists partly of calculations of the dissociations and dissociation-constants of highly dissociated acids, assuming various values for the mobility of the hydrogen ion. There is partial agreement with Ostwald's dilution-law. By means of partition measurements (between benzene and water) and determinations of conductivity and lowering of freezing-point, the following data were calculated :—

	k.	*x.*	K.
Trichloracetic acid	0·2–0·4	17·8	33
Dichloracetic acid	0·0515	20·6	5 (?)
aaβ-Trichlorbutyric acid	0·180	0·62	6·9
Sulphurous acid	0·016	0·70	—

k is the electrolytic dissociation-constant in water. In the case of H_2SO_3 the value given corresponds to the dissociation of the first hydrogen ion, *i.e.*, to the equilibrium, $H_2SO_3 = \overset{+}{H} + \overset{-}{HSO_3}$. *x* is the partition-constant, *i.e.*, $x = \frac{\text{Conc. of undissociated molecules in water}}{\text{Conc. of unassociated molecules in benzene}}$; K the "polymerisation-constant" in benzene, *i.e.*, $K = \frac{\text{Conc. of polymerised (double) molecules}}{\text{Square of concentration of simple molecules}}$. In the case of sulphurous acid (sulphur dioxide) the partition-constant refers to partition between water and chloroform (McCrae and Wilson, Zeitschr. Anorg. Chem. 35. 11, 1903). The methods of calculation of the dissociation in water from partition-measurements were the same as those previously employed by Rothmund and Drucker in the case of picric acid. In the present case, however, matters are complicated by the association of the acids in benzene, which introduces a new unknown quantity into the equations (the constant K), and greatly diminishes the value of the method as a test of the validity of the dilution-law in water. Some measurements on the distribution of picric acid between water and benzene in presence of iodic or hydrochloric acid in the aqueous solution led to a good agreement between theory and experiment in dilute solutions. In the case of stronger solutions, however, the "salting-out" action of the added acids masked the effects due to change of the hydrogen ion concentration. F. G. D.

248. *Constitution of Fluorvanadium Compounds.* **P. Melikoff** and **P. Kasanetzky.** (Zeitschr. Anorg. Chem. 41. 3. pp. 442–447, Oct. 8, 1904. Neu-russische Universität, Odessa.)—The so-called double compounds of vanadium fluoride may be represented by the formulæ $VO_2F . 2KF$ and $VO_2F . 3NH_4F$, or, considering them as potassium and ammonium orthovanadates in which one O atom is replaced by F_2 and the hydroxyl by F, by formulæ such as $\genfrac{}{}{0pt}{}{KO-}{KO-}V\genfrac{}{}{0pt}{}{-F}{=F_2}$, and the corresponding one where ammonium takes the place of the potassium. The author has endeavoured to decide between the two cases by oxidising the substances with hydrogen peroxide.

If the substances were double fluorides it would not be possible by oxidation to split off the whole of the fluorine or to obtain the ammonium salt of pervanadic acid; the authors have achieved both these results, and therefore have decided against the double formulæ. D. H. J.

249. *Stability and Solubility Relations of the Hydrates of Cerous Sulphate.* **J. Koppel.** (Zeitschr. Anorg. Chem. 41. 3. pp. 377–406, Oct. 8, 1904. Wissenschaftlich-chemisches Laborat., Berlin, July, 1904.)—The author has studied exhaustively the solubility of the different hydrates of cerium sulphate. The hydrates obtained by the author are $12H_2O$, $9H_2O$, $8H_2O$, $5H_2O$, and $4H_2O$. The dodecahydrate is stable from 0° to about 3°, the octahydrate from about 3° to 33°. At this temperature the enneahydrate becomes stable. The enneahydrate is therefore stable at higher temperatures than the octahydrate. At 41° the tetrahydrate becomes stable. The pentahydrate is not stable at any temperature, but its solutions are supersaturated either for enneahydrate or for tetrahydrate. In all cases, with exception of the dodecahydrate, the solubility diminishes with rise of temperature. With regard to the van't Hoff rule that the velocity of transformation increases with the valency of the metal, the author shows that in the case of the transformation of the salt $8H_2O$ to $9H_2O$ and of $5H_2O$ to $4H_2O$ this rule is obeyed, the velocity of transformation being slow. In the case of the transformations of the other hydrates, however, the delay is not observed, the difference of energy apparently coming in as a factor of moment. A. F.

250. *Complex Zinc Salts.* **F. Kunschert.** (Zeitschr. Anorg. Chem. 41. 3. pp. 337–358, Oct. 8, 1904. Elektrochem. Laborat. der techn. Hochschule, Braunschweig.)—An investigation, according to Bodländer's methods, of the state of combination of zinc in solutions containing alkaline oxalate, hydroxide, or cyanide. In concentrated solutions of ammonium or potassium oxalate zinc exists in the form of complex $Zn(C_2O_4)_3''''$ ions, which on dilution partially dissociate into $Zn(C_2O_4)_2''$ ions. In alkaline solutions zinc exists chiefly as ZnO_2'' ions, which are, however, partially hydrolysed to $HZnO_2'$ and OH' ions. Cyanide solutions contain both $Zn(CN)_4''$ and $Zn(CN)_3'$ ions. The paper contains measurements of the "stability constants" and free energy of formation (from the simple ions) of the foregoing complexes, together with a discussion of the results so obtained in relation to electro-analytical methods and the cyanide process of gold extraction. F. G. D.

251. *Fractional Hydrolysis of Amygdalinic Acid.* Iso-*Amygdalin.* **H. D. Dakin.** (Chem. Soc., Journ. 85. pp. 1512–1520, Nov., 1904.)—When amygdalinic acid is fractionally hydrolysed by means of barium hydroxide, the mandelic acid liberated in the early stages is strongly dextro-rotatory, whilst the acid set free towards the end of the reaction is lævo-rotatory; by suitable means the pure *d*- and *l*-mandelic acids can be isolated from the products of hydrolysis, but the yields are very small. By the action of cold barium hydroxide solution on amygdalin the latter undergoes isomerisation into *iso*-amygdalin, which crystallises with $2H_2O$, and has a specific rotation $[\alpha]_D$ of $-47{\cdot}6°$ at 16°. Like amygdalin, the *iso*-compound is attacked by emulsin and maltase, and yields the same products, though it is improbable that the speed of reaction is the same for the two substances. While amygdalin has the melting-point 216°, that of the *iso*- form is indefinite, and lies between 125° and 140°. Ordinary amygdalin may be converted into the *iso*-modification by the action of heat. T. H. P.

252. *Action of Amalgams upon Solutions.* **G. Fernekes.** (Journ. Phys. Chem. 8. pp. 566–570, Nov., 1904.)—The author replies to the criticisms made by Smith [see Abstract No. 2055 (1904)] on his paper on the action of sodium and potassium amalgams on various aqueous solutions [see Abstract No. 920 (1904)]. He confirms his previous results, and shows conclusively that barium in its amalgam is not replaceable by either sodium or potassium by the method which Smith thought possible by the ionic theory. According to Kahlenberg's theory, barium amalgam would be expected to act more slowly upon a solution of potassium or sodium chloride than upon pure water, because each molecule of the salt would influence the surrounding molecules of water by chemical attraction ; according to the ionic hypothesis, no such difference would be expected in the rates of reaction. Actual experiment shows that water acts about three times as rapidly upon barium amalgam as does potassium chloride solution. Smith has left out of consideration an essential factor, namely, chemical attraction, the importance of which is shown by the fact that when a solution containing equimolecular quantities of sodium and potassium chlorides is allowed to act on sodium amalgam, the amalgam is found, after 15 min., to contain only potassium, although more sodium than potassium is present in the solution at the end of the experiment, so that potassium has a greater affinity for mercury than sodium has, a result borne out by the heats of formation of sodium and potassium amalgams. The reason why barium in barium amalgam is not replaced by sodium or potassium from solutions of their salts is that there evidently exists a compound, the heat of formation of which so far exceeds that of either sodium or potassium amalgam as to render a replacement by these metals impossible.

T. H. P.

253. *New Data on the Polymerisation of Molecules in the Solid and Gaseous States.* **G. G. Longinescu.** (Annales Scientifiques de l'Univ. de Jassy, 8. pp. 26–34, Nov., 1904.)—The author has now established that the relationship $\{T/C \times D\}^2 = n$ (where "n" = the number of atoms in the molecule) is capable of giving us the number of atoms in the molecule of any body whatever, solid or liquid. The employment of the formula is general ; it is applicable even when the body does not boil without decomposition at the normal pressure. The following Table I. gives the results of applying the method to the elements :—

TABLE I.

	n calculated for the			*n* calculated for the			*n* calculated for the	
Substance.	Solid.	Liquid.	Substance.	Solid.	Liquid	Substance.	Solid.	Liquid.
Li	240	—	Co	23	—	Sn	5	—
Be	123	—	Ni	19	—	Sb	12	—
B	169	—	Cu	15	—	Te	16	—
C	327	—	Zn	6	5	I	9	2
Na	56	108	Ga	2	—	Cs	12	—
Mg	151	—	Ge	32	—	Ba	108	—
Al	49	—	As	12	—	Ce	30	—
Si	204	—	Se	8	7	Pt	35	—
P	12	9	Br	—	2	Au	18	—
S	14	12	Rb	36	—	Hg	1	1
Cl	—	3	Sr	100	—	Te	1	—
K	60	132	Zr	156	—	Pb	14	14
Ca	243	—	Pd	5	—	Bi	18	13
Cr	22	—	Ag	14	—	U	52	—
Mn	38	—	Cd	5	3			
Fe	28	—	In	4	—			

In comparing the periodicity of the above table with that of Mendeléef, we must remember that the data of the table are derived from values of the densities or of the boiling-points or melting-points as given in the literature, and such values are not always very reliable ; the general periodicity is, however, well marked. The following table gives further results for a number of inorganic compounds :—

TABLE II.

	n calculated for the			*n* calculated for the			*n* calculated for the	
Substance.	Solid.	Liquid.	Substance.	Solid.	Liquid.	Substance.	Solid.	Liquid.
AgF	7	—	$CdBr_2$	32	10	$SbBr_3$	9	4
$AgCl$	10	—	CdI_2	22	—	$SiHBr_3$	—	4
$AgBr$	14	—	$Cd(NO_3)_2 . 4H_2O$	26	—	$SiHI_3$	—	5
AgI	27	—	$Fe_2Cl_6 . 18H_2O$	23	—	KIO_3	57	—
$AgClO_3$	14	—	$GeCl_4$	—	6	KI	108	—
$AgNO_3$	12	—	$MnCl_2 . 4H_2O$	34	—	HIO_3	12	—
$AsCl_3$	—	5	$Ni(CO)_4$	—	8	ICl	12	—
$AsBr_3$	5	—	$PbCl_2$	90	72	HI	—	2
$CoCl_2 . 6H_2O$	24	—	$PbCl_4$	33	8	HBr	—	2
CoO_2Cl_2	—	5	PbI_2	60	19	BBr_3	—	3
CrO_3	—	16	$SeOCl_2$	10	6	S_2Br_4	—	5
$CuCl$	22	—	$SnCl_2$	31	22	$PSBr_3$	10	—
$CuBr$	18	—	$SnCl_4$	—	14	$POBr_3$	10	6
$CdCl_2$	53	21	$SbCl_3$	15	6	PBr_3	—	4

It will be seen that the greater number of the above inorganic compounds are polymerised. Cobalt chloride and cadmium nitrate give interesting results, as the water of crystallisation is seen to be constitutional. The author also tabulates his results for the organo-metallic compounds, which are found not to be polymerised ; the same applies to the organic alkyl and acidyl halides. [See also Abstract No. 2761 (1904).] D. H. J.

254. *Effect of Colloidal Platinum on Mixtures of Caro's Persulphuric Acid and Hydrogen Peroxide.* **T. S. Price** and **J. A. N. Friend.** (Chem. Soc., Journ. 85. pp. 1526–1533, Nov., 1904.)—In order to decide between the two formulæ suggested for Caro's acid, the authors have studied the action of colloidal platinum on mixtures of the acid and hydrogen peroxide, by which oxygen is rapidly evolved. If the formula were H_2SO_5, a reaction of the second order might be anticipated, according to the equation : $H_2SO_5 + H_2O_2 = H_2SO_4 + H_2O + O_2$; but if it were $H_2S_2O_9$ one would expect a reaction of the third order : $H_2S_2O_9 + 2H_2O_2 = 2H_2SO_4 + H_2O + 2O_2$. The results obtained show, however, that the formula cannot be determined in this way, as it is not found possible to obtain constants of any order. If the concentrations of the hydrogen peroxide and Caro's acid are kept constant, no simple connection can be traced between the concentration of the platinum employed and the volume of oxygen evolved. T. H. P.

255. *Solubility of Dynamic Isomerides.* **T. M. Lowry** and **W. Robertson.** (Chem. Soc., Journ. 85. and 86. pp. 1541–1550, Nov., 1904.)—Whilst the rotatory power affords a general method for studying the dynamic isomerism of optically active substances, no similar method is available in the case of inactive bodies, since most physical properties differ relatively little in isomeric compounds. The solubility of dynamic isomerides is, however, usually very different, and under certain conditions it is possible to follow quantitatively the changes of dynamic isomerides by means of the changes in solubility. If the less soluble isomeride is initially in contact with the solvent the solubility gradually increases until the liquid phase contains a normal proportion of the two forms. If, however, the more soluble isomeride is used, the solubility increases until the liquid is saturated with both forms ; the solution then contains a much greater proportion of the more soluble isomeride, and isomeric change proceeds continuously, the more soluble modification dissolving whilst the less soluble form separates from the solution; finally, when the whole of the more soluble form has dissolved, the solubility decreases to a constant value identical with that obtained when the less soluble isomeride alone is used. The experiments described in the paper afford the first examples of the investigation of reversible isomeric change by means of solubility measurements and serve to show that the method is a practical one. The mutarotation of nitro-camphor and its bromo-derivatives has already been studied, but the proportions when the isomerides are in equilibrium were unknown till the authors showed that in the case of nitro-camphor and its π-bromo-derivative, the normal and pseudo-forms are in equilibrium when present in the ratio of 5 to 1 approximately. D. H. J.

256. *Solubility of Dynamic Isomerides.* **T. M. Lowry.** (Chem. Soc., Journ. 85. and 86. pp. 1551–1570, Nov., 1904.)—The solubility method [see preceding Abstract] first applied to the nitro-camphors, has now been used to determine the proportion of α-glucose and of α-galactose in the mixture of the dynamic isomerides which are formed when these sugars are dissolved in alcohol or in water. The main result of the experiments is to show that in the case of glucose and galactose the proportion of α-sugar in solution decreases as the amount of water in the solvent increases. This result is ascribed to the presence in the aqueous solutions of a third form of the sugar. In methyl-alcoholic solutions, one-half of the sugar is in the α-form. The remainder probably consists almost entirely of the β-sugar, since the third form can be present only in very minute quantities. The α and β forms are therefore equally stable in the solution, although the α-form, being the less soluble, is the first to crystallise when the solution is evaporated. In the mixture ($EtOH + H_2O$), the proportion of α-sugar falls to 40 per cent. This might be due to the presence of 60 per cent. of the β-sugar. A more probable explanation is that the solution contains equal proportions of the α- and β-forms and 20 per cent. of a third hydrated form. On account of the excessive solubility of glucose and galactose in water, the measurements could not be extended to aqueous solutions, but it is clear that an even smaller ratio of initial to final solubility must be anticipated under these conditions. It is therefore evident that although in anhydrous solvents the mutarotation of glucose and galactose may be almost wholly due to isomeric change, the change of rotatory power in aqueous solutions may be to a large extent due to the formation of a third hydrated form of the sugar. It is probable that the third form of the sugar is the aldehydrol, and that this forms an intermediate stage in the interconversion of the stereoisomeric α- and β-sugars. D. H. J.

257. *Hydrolysis of Cane Sugar by* d- *and* l-*Camphor-β-Sulphonic Acids.* **R. J. Caldwell.** (Roy. Soc., Proc. 74. pp. 184–187, Nov. 1, 1904.)—Since the enzymes must have an asymmetric structure, it is of interest to examine the hydrolytic action of other asymmetric compounds on sugar solutions. In the hydrolysis of cane sugar by *d*- and *l*-camphoric acids, Fischer found no difference in velocity. The author finds the same to be the case with the isomeric *d*- and *l*-camphor-β-sulphonic acids. Both these acids act so rapidly that their action may be examined at 20°. Taking the activity (k) of hydrochloric acid as 100, that of the camphor-sulphonic acids is 89·8. For the hydrolysis of milk sugar at 60·1° by hydrochloric acid, $k = 3{\cdot}53$, while with the camphorsulphonic acids, $k = 2{\cdot}43$, the ratio being 100 : 70. T. H. P.

258. *Hydrolysis of Isomeric Glucosides and Galactosides by Acids and Enzymes.* **E. F. Armstrong.** (Roy. Soc., Proc. 74. pp. 188–194, Nov. 1, 1904.)—The suggestion, put forward by Bourquelot and Herissey, that the action of emulsin on milk sugar is due to the presence of small quantities of lactase, together with the emulsin proper, is improbable owing to the facts: (1) That the curve expressing the rate at which milk sugar changes is not of the form to be expected if only a very small quantity of enzyme (lactase) were present, as then a linear expression should apply during the early stages; actually the curve is only of this form when small quantities of emulsin are used. (2) That the action of emulsin on milk sugar is most retarded by dextrose and only to a slight extent by galactose, whereas the latter alone affects the action of lactase. (3) The curves for emulsin fall off very much more rapidly than those for lactase, showing that the action of the products in removing the enzyme is greater in the former case. It would seem, therefore, that emulsin is capable of acting on β-galactosides as well as β-glucosides. With the α- and β-glucosides and the α- and β-galactosides where the stereo-isomerism in each pair of compounds is confined to the terminal carbon atom, the β-compounds undergo hydrolysis by acids much more readily than the corresponding α-compounds. Further, on passing from a glucoside to the corresponding galactoside—involving a change in the general configuration at the fourth carbon atom, affecting only the nature of the attachment of the oxygen atoms within the ring—a marked influence is exerted on the activity of the group associated with the terminal carbon atom, the galactoside being far more readily hydrolysable than the glucoside. Maltose is hydrolysed more rapidly by yeast extract than α-methyl-glucoside, and, in both cases, the velocity coefficient of the change diminishes as action proceeds, but to a far greater extent with maltose; the value of K for the latter is about six times as great as that for the glucoside. The hydrolysing activity of the enzyme is much greater than that of acids. T. H. P.

259. *Kinetics of the Reaction between Permanganate and Oxalic Acid.* **A. Skrabal.** (Zeitschr. Anorg. Chem. 42. 1. pp. 1–59, Nov. 7., 1904. Laborat. f. Analyt. Chemie an der k.k. techn. Hochschule, Wien, July, 1904.)—Harcourt and Essen have already shown that the reaction between permanganate and oxalic acid is monomolecular. The author first shows that the reaction really measured, using excess of oxalic acid and having manganese sulphate present at the commencement of the reaction, is the decomposition of a complex manganic oxalate :—

$$[\mathrm{Mn(OH)_3 . C_2H_2O_4}] \longrightarrow \mathrm{Mn(OH)_2 + CO_2} \ldots\ldots\ldots\ldots\ldots\ldots\ldots(a).$$

It is really the manganic ions which oxidise the oxalic acid, so that the reaction (a) must be split up as follows :—

$$[\mathrm{Mn(OH)_3 . C_2H_2O_4}] \longrightarrow \mathrm{Mn}^{\cdots} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(b).$$
$$\mathrm{Mn}^{\cdots} + \mathrm{C_2H_2O_4} \longrightarrow \mathrm{Mn(OH)_2 + CO_2} \ldots\ldots\ldots\ldots\ldots\ldots(c).$$

The action of equivalent quantities of manganic salt in the form of phosphate and acetate on the oxalic acid did not lead to a reaction of higher order. (From this it necessarily follows that the reaction: manganic complex + oxalic acid $\longrightarrow$ $\mathrm{Mn(OH)_2 + CO_2}$ must be split up into at least two component reactions, of which the one capable of measurement must be monomolecular.) Neither an increase in the concentration of the oxalic acid, nor dilution of the reaction mixture to twice its volume, caused an alteration in the velocity coefficient of (*a*). It follows that the reaction (*c*) proceeds too quickly for measurement. Consequently only the reaction (*b*), that is the velocity of the electrolytic dissociation of the manganic salt, can be measured ; this is a reaction of the first order. If the velocity constants are to be satisfactory only one manganic complex salt must be present ; if two are present, one of them undergoes reaction quicker than the other, and a constant adjustment of the equilibrium between the two complexes is necessary ; this has an effect on the constants. The reaction (*b*) is really an equilibrium, practically all on the side of the complex salt ; it therefore follows that good velocity constants will only be obtained with excess of oxalic acid. If the reaction mixture contains no manganous salt to commence with, the oxalic acid is at first only very slowly oxidised by the permanganate (period of incubation). After a time manganic salt is formed, and during this period a rapid induced oxidation of the oxalic acid takes place. After this induced oxidation follows the reaction of the first order already mentioned. The intermediate formation of manganic ions was shown to be the cause of the coupling of the induced oxidation of the oxalic acid. Manganese peroxide behaves similarly to permanganate in its action on oxalic acid. The reaction permanganate-oxalic acid can accordingly be formulated as follows :—

$$\begin{array}{ll}
\left.\begin{array}{l}
C_2H_2O_4 + KMnO_4 \longrightarrow Mn^{\cdots} + CO_2\text{. (measurable) .... (1)} \\
C_2H_2O_4 + Mn^{\cdots} \longrightarrow Mn(OH)_2 + CO_2\text{. (pract. instantaneous) (2)}
\end{array}\right\} & \text{Incubation period.} \\
\left.\begin{array}{l}
Mn(OH)_2 + KMnO_4 \longrightarrow \text{Mn.}^{\cdots}\text{ (not so quickly) .... (3)} \\
Mn^{\cdots} + C_2H_2O_4 \longrightarrow Mn(OH)_2 + CO_2\text{. (pract. instant.) ...... (4)} \\
Mn^{\cdots} + C_2H_2O_4 \longrightarrow [Mn(OH)_3 . C_2H_2O_4 .]\text{ (pract. instant.) (5)} \\
Mn^{\cdots} \longrightarrow Mn(OH)_2 + Mn(OH)_4\text{ (pract. instant.)............... (6)}
\end{array}\right\} & \text{Induction period.} \\
\left.\begin{array}{l}
\left.\begin{array}{l}
[Mn(OH)_3 . C_2H_2O_4] \longrightarrow \text{Mn.}^{\cdots}\text{ (measurable)..................... (7)} \\
C_2H_2O_4 + Mn^{\cdots} \longrightarrow Mn(OH)_2 + CO_2\text{. (pract. instant.) ...... (8)}
\end{array}\right\}\text{I.} \\
\left.\begin{array}{l}
Mn(OH)_2 + Mn(OH)_4 \longrightarrow \text{Mn.}^{\cdots}\text{ (not so quickly)............... (9)} \\
C_2H_2O_4 + Mn^{\cdots} \longrightarrow Mn(OH)_2 + CO_2\text{. (pract. instant.) ......(10)}
\end{array}\right\}\text{II.}
\end{array}\right\} & \text{End period.}
\end{array}$$

The velocity of the reaction (1) increases with increasing acidity. The decomposition according to (4) is all the greater, the slower the reaction (3) proceeds, in consequence of a small concentration of manganous ions. By adding manganous sulphate the incubation period is done away with, the reaction of the induction period which is capable of being measured proceeds very quickly, and the decomposition according to (4) is very small. If the conditions are favourable for the formation of complex manganic salts, that is, great concentration of oxalic acid and small concentration of hydrogen ions, the reaction (5) of the induction period proceeds more quickly, and the end period goes on according to I. In other cases reaction (6) is the chief one, and the end period proceeds as given by II. The halogen acids act similarly to oxalic acid in their behaviour with manganic salts, manganese dioxide, and permanganate. T. S. P.

260. *Primary Oxide Theory of Oxidation Processes.* **A. Skrabal.** (Zeitschr. Anorg. Chem. 42. 1. pp. 60–86, Nov. 7, 1904. Laborat. f. analyt. Chemie der k.k. techn. Hochschule, Wien, May, 1904.)—The author has arrived at the following conclusions : In oxidation and reduction processes primary "oxidions" are first formed. The latter are characterised by the fact that, under the conditions of experiment, they can decompose into two oxidation-stages

(Oxydationsstufen), *e.g.*, the primary oxidion $Cu^{\cdot}$ can decompose into Cu and $Cu^{\cdot\cdot}$, according to the equilibrium $2Cu^{\cdot} \rightleftarrows Cu^{\cdot\cdot} + Cu$. All processes of oxidation can be analysed into primary reactions. No matter whether the oxidation can be measured, or proceeds immeasurably quickly or slowly, the reduction of the primary oxidions by acceptors proceeds very much more quickly than the primary reaction, by means of which the primary oxidions are formed. The same holds for the decomposition of the primary oxidions into two oxidation stages, or the transformation of these into complex or dissociated compounds. In obtaining the above results the author has made use of the following: (1) Ostwald's law of reaction in stages. (2) The deductions of Luther in connection with substances possessing several oxidation stages. (3) The assumption that all reactions are more or less of an ionic character. (4) The kinetic conception of chemical equilibrium. (5) The numerous observations and investigations which have been made of oxidation processes. [See also Abstract No. 1752 (1902).] T. S. P.

261. *Formation of Perborates by Action of Boric Acid on Alkaline Peroxides.* **G. F. Jaubert.** (Comptes Rendus, 139. pp. 796–798, Nov. 14, 1904.)—When an intimate mixture of boric acid and sodium peroxide is gradually added to cold water, a snow-white crystalline deposit is thrown down, which, when separated by filtration and dried at 50° C., has the composition—

$$Na_2B_4O_8 + 10H_2O,$$

and is termed by the author perborax. The body is stable at ordinary temperatures, but when dissolved in water liberates hydrogen peroxide, and attempts to recrystallise it produce at first crystals richer in oxygen than perborax, those last formed, however, containing no active oxygen. By neutralising half the sodium of the compound by a mineral acid, another white crystalline body separates, corresponding to the formula $NaBO_3 + 4H_2O$, which is stable at ordinary temperatures, and is called by the author sodium perborate on account of analogies with the persulphates. Sodium perborate is less soluble in water than perborax, but readily dissolves with slight decomposition at 50–60°. Its aqueous solution, without the addition of any acid, has all the properties of hydrogen peroxide, and is equally effective as a bactericide. W. H. Si

262. *Molecular Weight Determinations in "Solid Solutions."* III. *Isomorphous Mixtures of* p-*dichlorobenzene with* p-*dibromobenzene and of* s-*trichlorophenol with* s-*tribromophenol.* **F. W. Küster.** (Zeitschr. Phys. Chem. 50. pp. 65–80, Nov. 18, 1904. Laborat. der kgl. Bergakademie, Clausthal, July, 1904. From the Dissertation of W. Würfel.)—The compositions of the liquid and solid phases in the case of saturated solutions of mixtures of the two first-mentioned substances in an aqueous-alcoholic solvent were determined. Although the substances exist in a monomolecular state in the solvent, an application to the isomorphous crystalline phases of the law applicable to solid solutions leads to the conclusion that these phases consist of a mixture of single and double molecules. The author does not appear to regard this conclusion as satisfactory. In the case of the second pair of isomorphous substances mentioned above, matters are complicated by isodimorphism and the appearance of two series of solid solutions. So far as concerns the concentrations in the liquid and solid phases of the stable and labile forms of the chlorine derivative, and of the labile form of the bromine derivative, simple proportionality appears to hold good through very considerable ranges. In the case, however, of the stable form of the bromine derivative, *i.e.*, in the case of that series of solid solutions which corresponds in crystalline form to this derivative, it is found that there is an *increasing* percentage of bromine in the solid crystals with a *decreasing* concentration of bromine (combined, of course) in the solution. The author endeavours to explain this anomaly by supposing that the bromine compound forms complexes in the solution with the chlorine derivative. Boiling-point determinations appear to confirm this supposition. F. G. D.

263. *Double Chlorides of Iron. Solubility of Cæsium Chloride.* **F. W. Hinrichsen** and **E. Sachsel.** (Zeitschr. Phys. Chem. 50. pp. 81–99, Nov. 18, 1904. From the II. chem. Laborat. der Univ., Berlin.)—A saturated solution of cæsium chloride contains at—

Temp.			
0·3°	61·9	per cent.	of cæsium chloride.
10	63·5	”	”
20	64·9	”	”
30	66·3	”	”
40	67·4	”	”

It is important to know the exact composition of as many double salts as possible in view of Werner's introduction of the conception of "co-ordination numbers" to express the number of atoms of an element which can enter into direct combination with another element; as a contribution to the subject the authors have re-examined the double-chlorides of iron, with the following results: (1) By solubility and dilatometric measurements it was proved that for temperatures between 0° and 60° no double salt of sodium chloride and ferric chloride exists. (2) Between the above temperatures only one double salt of potassium chloride and ferric chloride exists, viz., $FeCl_3 . 2KCl . H_2O$. When potassium chloride is present in excess in the solution mixed crystals are obtained. The transformation temperature for the creation of the double compound from the single salts lies between 22° and 22·5°. (3) In the case of cæsium chloride two double salts are stable at 21°. From a solution containing an excess of the cæsium chloride the salt $FeCl_3 . 3CsCl . H_2O$ separates; from an excess of ferric chloride the salt $FeCl_3 . 2CsCl . H_2O$. The temperature for the formation of the double salt of the type 1 : 2 lies between 39·5° and 39·8°. D. H. J.

264. *Hydrogenation of Aromatic Ketones by Reduced Nickel. New Synthesis of Aromatic Hydrocarbons.* **G. Darzens.** (Comptes Rendus, 139. pp. 868–870, Nov. 21, 1904.)—The catalysing properties of reduced nickel increase as the fineness of its state of division increases and decrease as the temperature of reduction rises. This variation in the power of hydrogenation is revealed not only by the amount of substance acted upon, but also by the nature of the chemical action effected. Thus, nickel reduced from the oxide, NiO, at 300° converts an aromatic ketone, $C_6H_5 . CO . R$ into the compound $C_6H_5 . CH_2 . R$. But with a more active nickel, that is, one prepared at a lower temperature, the corresponding hexahydro-derivative is obtained. This method may therefore be employed for the synthesis of aromatic hydrocarbons, and it is found to be also applicable to aromatic ketones in which the carbonyl group is present in a side chain. T. H. P.

265. *Determination of Neutralisation-Points by Conductivity Measurements. II. Applications.* **F. W. Küster, M. Grüters, and W. Geibel.** (Zeitschr. Anorg. Chem. 42. 2. pp. 225–234, Nov. 21, 1904. Chem. Institut der Bergakademie, Clausthal, Sept., 1904.)—In continuation of a previous paper [see Abstract No. 416 (1904)] the author shows how very exact acidimetric and alkalimetric determinations can be carried out by plotting conductivities as ordinates against c.cm. of added alkali or acid. The method is very useful in the case of coloured liquids, and in many cases where the ordinary indicators do not give sharp results. The paper contains satisfactory applications of the method in the following cases: Sulphuric acid + potassium bichromate, sulphuric acid + potassium permanganate, vinegar, acetic, lactic, tartaric, and citric acids; magnesia, quinine, cinchonine, cinchonidine, quinidine. In the case of the quinine alkaloids, the base is dissolved in excess of HCl, and titrated back with $Ba(OH)_2$. The break in the curve appears to be very sharp. In the case of comparatively weak organic acids, such as acetic, &c., it is necessary in order to obtain a sharp break to add the acid to the alkali, and not *vice versâ*.
F. G. D.

266. *Action of Nascent Hypoiodous Acid on Acids Containing an Ethylene Linkage.* **J. Bougault.** (Comptes Rendus, 139. pp. 864–867, Nov. 21, 1904.)—Adding iodine and yellow mercuric oxide to solutions of various unsaturated acids dissolved in ether saturated with water, very different results are obtained according to the position of the ethylene bond. If in the $\alpha\beta$ position or otherwise directly attached to the same carbon atom as the carboxyl group, no addition compound is obtained, though one is probably formed, but destroyed during the subsequent treatment with potassium iodide to remove the precipitated mercuric iodide. Acids in which the double linkage has the $\beta\gamma$ position, add an hypoiodous acid, forming lactones which are useful for the complete separation of these acids from mixtures with the isomeric $\alpha\beta$ acids, the iodo-lactones yielding, on treatment with zinc and acetic acid, the original $\beta\gamma$ acid again. In this case it is advantageous to produce the hypoiodous acid by treating iodine with an aqueous solution of an alkaline carbonate, the solubility of the sodium salts of the acids, and the insolubility of the lactones rendering the reaction very sensitive, it being possible to separate 1 cgm. of hydropiperic or hydrosorbinic acids when mixed with 3 or 4 gm. of the $\alpha\beta$ isomers. Some of the iodo-lactones thus obtained are liquid, but as a general rule they crystallise much more easily than the lactones themselves. The action of hypoiodous acid on acids containing an ethylene linkage in the $\gamma\delta$ position is still under examination, but on those in which it is further from the carboxyl group, saturated addition compounds are formed, their acid character remaining unchanged.
W. H. St.

267. *Colloidal Tellurium.* **A. Gutbier.** (Zeitschr. Anorg. Chem. 42. 2. pp. 177–183, Nov. 21, 1904. Chem. Laborat. der kgl. Universität, Erlangen, March, 1904.)—The author has already given an account of the experiments by which he obtained colloidal tellurium [see Abstract No. 3074 (1904)]; in these experiments the following reducing agents were employed to reduce tellurium dioxide or trioxide, viz., hydrazine, hypophosphorous acid, hydroxylamine, sulphur dioxide, electrolytic nascent hydrogen in presence of potassium cyanide. The present paper contains a somewhat fuller account of the older experiments, together with a few fresh observations. If the reduction

with the above-mentioned reducing agents is conducted in presence of gum arabic, the stability of the resulting hydrosol of tellurium is very much increased. Phenyl hydrazine is well suited both to show the gradual formation of colloidal tellurium from the dioxide, and to yield a product which is very stable. D. H. J.

268. *Tin-Amalgams.* **W. J. van Heteren.** (Zeitschr. Anorg. Chem. 42. 2. pp. 129–173, Nov. 21, 1904.)—This paper forms an exhaustive study of tin-amalgams, including measurements of the melting-point curve, the concentrations of the solid and liquid phases, and a determination of the electromotive behaviour of tin-amalgams. The following are some of the principal results: (1) In the liquid phase Sn and Hg mix in all proportions. (2) The initial freezing-points of these mixtures when plotted against composition form two lines; the first runs from 231·6° (m.-pt. of pure tin) to − 34·5° for concentrations of tin from 100 to 0·3 atomic per cent., the second from − 34·5° to − 38·6° (m.-pt. of mercury) for 0·3–0 atomic per cent. of tin. (3) The solid phase corresponding to the first line is either pure Sn or Sn containing very little Hg. At 25° its composition was found to be 94 atomic per cent. of tin by direct analysis, whilst the more accurate electrical measurements gave its composition as 99 atomic per cent. (4) Amalgams from 0·3 to 85 atomic per cent. tin undergo a transformation at − 34·5°, whereby a new solid phase consisting probably of isomorphous mixed crystals makes its appearance; in this phase tin occurs in a new modification unknown in the free state. (5) Between − 34·5° and − 38·6° these isomorphous mixtures crystallise out, with expansion. F. G. D.

269. *Electrical Conductivity and other Properties of Sodium Hydroxide in Aqueous Solution as Elucidating the Mechanism of Conduction.* **W. R. Bousfield** and **T. M. Lowry.** (Roy. Soc., Proc. 74. pp. 280–283, Dec. 10, 1904.)—Taking into account the effects of temperature on the density and viscosity of a solution and on the dielectric constant, the authors propose the formula—

$$\frac{\kappa_t}{\kappa_0} = \frac{\rho_t}{\rho_0}(1 + bt)^n e^{-at}$$

for the variation of conductivity with temperature (κ = conductivity, ρ = density, b, n, a = constants). The authors have measured the density and conductivity of solutions of NaOH at 18° C., as well as the temperature-coefficients of these properties. Neither dilute nor concentrated solutions of NaOH exhibit an inflection-point in the conductivity-temperature curve between 0° and 100° C., whilst moderately strong solutions do. The quotient obtained by dividing the molecular conductivity by the "fluidity" is termed the *intrinsic conductivity* of the solution. In the case of NaOH solutions, this quantity falls to a minimum at about 8 per cent., and then rises until at 50 per cent. NaOH its value is considerably greater than in the most dilute solutions. It is found that a formula of the type—

$$\rho_t = \rho_0 + \alpha t + \beta t^2 + \gamma t^3$$

represents the influence of temperature on density in the case of water and dilute solutions of NaOH. When a concentration of 12 per cent. is reached, the cubical term becomes unnecessary, and at 42 per cent. the quadratic term can be dispensed with. The view is advanced that this progressive simplification is due to a destruction of the complex water molecules by the NaOH.

The molecular volume of NaOH in dilute solutions has a large negative value. The molecular volume does not increase continuously with temperature, but reaches a maximum value at about 70° C. F. G. D.

270. *Chemical Determination of the Ozone Potential.* **S. Jahn.** (Zeitschr. Anorg. Chem. 42. 2. pp. 203–212, Nov. 21, 1904. Institut für physik. Chemie, Göttingen, Aug., 1904.)—Ozone liberates chlorine from aqueous solutions of hydrochloric acid, and at equilibrium between ozone, chlorine, and acid, the potential of the ozone electrode will be equal to that of the chlorine electrode, determined in the same liquid. The latter can be measured, and Nernst has hence devised a chemical method for deducing the ozone potential by passing a stream of ozone of constant percentage through diluted hydrochloric acid. The author ozonises electrolytic oxygen in a Siemens' apparatus, and adds Bredig's colloidal Pt to the HCl to quicken the reaction; the partial pressure of the Cl and the concentration of the ions can be calculated from conductivity measurements. Some chloric acid may be formed, but it would not under the experimental conditions influence the results; ClO_2 does not appear to be formed. The ozone potential against a hydrogen electrode rises in the course of hours to a maximum value of 1·54 volts, just as in Gräfenberg's electrolysis of sulphuric acid with platinised platinum. H. B.

271. *Electrolytic Oxidation of Phenols.* **A. G. Perkin** and **F. M. Perkin.** (Chem. Soc., Journ. 85. pp. 243–247, Feb., 1904.)—In oxidising pyrogallol to purpurogallin a 15 per cent. solution of sodium sulphate is used as electrolyte, giving a very pure bright orange-coloured product. The best results were obtained with a rotating platinum anode, with no separation of anode and kathode. The average yield was 36 per cent., though on two occasions a 46 per cent. yield was obtained; nitrous acid yields only 25 per cent. of the crude product. In preparing purpurogallin carboxylic acid from gallic acid, it was found necessary to separate the anode and kathode. The only satisfactory electrolyte was a 15 per cent. solution of sodium or ammonium acetate acidified with acetic acid. The yield of the crude product varies greatly, from about 20 to 50 per cent. After purification the product was found to be identical with that obtained by oxidation with potassium ferricyanide. T. M. L.

272. *Electrolytic Preparation of Iodoform from Acetone.* **J. E. Teeple.** (Amer. Chem. Soc., Journ. 26. pp. 170–177, Feb., 1904.)—Current yields of iodoform varying from 89 to 96 per cent. are obtained in the electrolysis of a neutral solution of potassium iodide in presence of acetone. It is necessary to neutralise the potassium hydroxide produced during the electrolysis as it is formed, and this may be done by means of carbon dioxide, hydrochloric or hydriodic acid, or iodine. The other conditions to be observed are: the temperature should not be permitted to exceed 25°, the solution should be kept well stirred, the anode current density should be comparatively low and the kathode current density high. When a rotating anode is used and iodine serves as the neutralising agent, the yield of iodoform per amp.-hour amounts to 3·34 gm., which is considerably higher than is obtained by other processes. It is found that the yield gradually decreases if the process is made continuous, owing to the accumulation of potassium acetate, but the diminution only amounts to about 15 per cent. when the proportion of potassium acetate in the solution is 12 per cent. T. H. P

273. *Electrolytic Preparation of Chloroform from Acetone.* **J. E. Teeple.** (Amer. Chem. Soc., Journ. 26. pp. 536–543, May, 1904.)—In the preparation of chloroform by the electrolysis of a solution of sodium or potassium chloride in presence of acetone, the current density at the anode should be not more than 6 amperes, and that at the kathode—conveniently a platinum wire—considerably higher. The alkali generated should be, for the most part, neutralised as it is formed by the passage of a slow current of chlorine through the liquid, but the solution may be slightly alkaline; the yield of chloroform is diminished if the alkali is allowed to accumulate. The temperature of the solution should be kept below 25°. Some of the chloroform produced is kept in solution by the acetone, but the loss in this way would be small in the industrial working of the process.

T. H. P.

274. *Electrolytic Estimation of Tellurium.* **G. Pellini.** (Accad. Lincei, Atti, 13. pp. 275–277, Sept. 4, 1904.)—By the use of a rotating kathode in the determination of tellurium by electrolysis of a solution to which is added ammonium hydrogen tartrate [see Abstract No. 2791 (1904)], it is found possible to estimate larger quantities of tellurium, even over 1 per cent., and the author hopes after further work to render the process suitable for the purification of the metal also. The method now adopted consists in dissolving a weighed amount of tellurium in nitric acid, driving off the latter on a water bath, then adding 10 c.cm. of concentrated sulphuric acid, and warming for some time in a sand bath. After cooling, 30–40 c.cm. of a saturated solution of ammonium hydrogen tartrate are added, the mixture boiled till the tellurous acid dissolves, and the whole made up with the tartrate solution to 250 c.cm. Electrolysis is carried out at 60°, employing a current 0·12–0·09 amp. per 100 sq. cm. and a p.d. between the electrodes of 1·8–2·2 volts. The kathode makes about 800–900 r.p.m. When electrolysis is complete, *i.e.*, when no brown colouration is produced by warming 2 c.cm. of the liquid with a few drops of HCl and $SnCl_2$, the current is interrupted, and the deposit rapidly washed with boiled, oxygen-free water while the kathode is still rotating. It is then washed with absolute alcohol, dried in the oven at 90–95° for 10 min., and weighed. If the current is maintained during the washing of the deposit, dilution of the liquid causes solution of the tellurium, probably in the colloidal form, with a violet-brown colour.

W. H. Sı.

275. *Anodic Evolution of Oxygen.* **F. Foerster** and **A. Piguet.** (Zeitschr. Elektrochem. 10. pp. 714–721, Sept. 9, 1904. Elektrochem. Laborat. d. techn. Hochschule, Dresden.)—Results are given of an examination of the behaviour of smooth, matt and platinised platinum, smooth iridium, palladium, nickel and iron anodes in potassium hydroxide solution, the current being kept constant at 0·033 amp. per sq. cm., and the e.m.f. measured from time to time. When the kathode is of platinised platinum, the whole of the change of e.m.f. occurs at the anode. In all cases the e.m.f. rises with greater or less rapidity to a final value constant for any particular anode. Similar results are obtained with the platinum metals in sulphuric acid solution. The authors favour the view that a thin layer of absorbed gas is formed on the surface of the electrode.

T. H. P.

276. *Electrolytic Iron.* **A. Skrabal.** (Zeitschr. Elektrochem. 10. pp. 749–752, Sept. 23, 1904.)—The author has already described methods for the electro-deposition of iron. The lately published work of Burgess and Hambuechen [see Abstract No. 1918B (1904)] has induced him to give further details. He distinguishes two kinds of electrolytic iron which he denotes A-iron and B-iron. The former is silver-white, compact and very hard. To obtain it iron is used as anode with small voltage and current-density, the electrolyte an iron salt. To obtain B-iron, which is of a greyer colour, a greater pressure and current-density is used, and the anode is of platinum. Between these two there are intermediate varieties which can be obtained by varying some of the conditions. A comparison is made of the types of iron described by other observers, and microphotographs are given showing the crystalline structure of iron deposited by the author's process.

W. W. H. G.

277. *Action of Bromine on Alkali, and Electrolysis of Alkali Bromides.* **H. Kretzschmar.** (Zeitschr. Elektrochem. 10. pp. 789–817, Oct. 7, 1904. Communication from the Elektrochem. Laborat. d. Techn. Hochschule, Dresden.)—The work consists of chemical and of electrolytical researches. In the analyses, hypobromite is determined after Penot with the aid of arsenious acid, bicarbonate being added to mark the end of the reaction; bromate from the total oxygen by Pauli's method with thiosulphate; free hypobromous acid with the aid of hydrogen peroxide, used by Foerster and Jorre for determining free hypochlorous acid; bromide after Volhard. The electrolysis of NaBr and KBr, was conducted on the lines of Pauli and of Oettel with simultaneous gas analyses in a glass beaker, without diaphragm and with sheet, wire, or grid electrodes of platinum—parallel experiments being always made with smooth and with platinised electrodes. In the electrolysis of hypobromite of sodium, a diaphragm (clay cell) was used. Bromine and alkali always give in the first instance hypobromite according to $Br_2 + OH' \rightleftharpoons HOBr + Br'$, and $HOBr + OH' \rightleftharpoons BrO' + H_2O$; afterwards bromate results: $2HOBr + MOBr = MO_3Br + 2HBr$, as in chlorate formation, but much more rapidly. The electrolysis of bromides yields in all solutions free bromine and alkali which unite to hypobromite, besides free oxygen (by discharge of OH-ions), up to 9 per cent. of the current being absorbed for this oxygen generation at smooth electrodes, and 1 per cent. at platinised electrodes. The hypobromite is chemically oxidised to bromate, and in alkaline solutions also by anodic oxidation. The discharge of BrO'-ions is unimportant, but plays a considerable part in the case of the chloride electrolysis. Summing up after Foerster [see Abstract No. 2789 (1904)], the author states that iodate is always formed secondarily; bromate also anodic in alkaline solutions; and chlorate secondarily in acid solutions, and by anodic oxidation in neutral and in alkaline solutions.

H. B.

278. *Electrolytic Behaviour of Carbonates and Solid Bodies.* **F. Haber** and **S. Tolloczko.** (Zeitschr. Anorg. Chem. 41. 3. pp. 407–441, Oct. 8, 1904. Chemisch.-techn. Inst. d. techn. Hochschule, Karlsruhe.)—Experiments were first made with caustic soda. When heated to about 240° C. and then allowed to cool, it was found to be apparently conducting. This was due to conducting canals of not completely solid substance. When cooled to the temperature of the room the conducting power ceased. The current efficiency obtained with a temperature under the melting-point was 39–46 per cent. This has some technical interest as showing that it is possible, not only to obtain sodium from fused caustic (as in Castner's process), but also at temperatures much lower than the melting-point. It was found that chloride of barium furnished *a true example* of a solid electrolyte, being decomposed 400° under its melting-point. A number of experiments were also made with a mixture of barium chloride and barium carbonate from which, at temperatures below 600°, carbon was obtained with high current efficiency. The values of the polarisation e.m.f. were obtained in the several cases and compared with the estimates that follow from Thomson's law. Finally, a solid Daniell's cell was designed. In one type lead chloride with lead, and silver chloride and silver were the substances used. W. W. H. G.

279. *Catalytic Action in Electrolysis.* **C. J. Thatcher.** (Electrochem. Ind., N.Y. 2. pp. 452–454, Nov., 1904.)—The author refers to his electrolytic conversion of sodium thiosulphate into tetrathionate [see Abstract No. 1577 (1904)] as exemplifying the importance of catalytic actions in Ostwald's sense. The reaction $S_2O_3 \longrightarrow S_4O_6$, which is an oxidation process, is very slow in the absence of platinum (anodes of platinised platinum) and is again retarded by any poison like $Hg(CN)_2$, which interferes with this catalysis. To secure a good yield of $Na_2S_4O_6$, the concentration of the oxygen has further to be kept low; this is attained by adding a little KI to the electrolyte so that the oxygen formed at the anode liberates iodine according to $2I' + \frac{1}{2}O_2 + H_2O = I_2 + 2OH'$. The author emphasises the utility of catalytic agents in analysing electrode processes and in synthetic electrolysis. H. B.

280. *Electrolysis of Acid Solutions of Aniline.* **L. Gilchrist.** (Journ. Phys. Chem. 8. pp. 539–547, Nov., 1904.)—In determining decomposition-voltages in acid solutions of aniline, electrolytic hydrogen must be used in place of hydrogen from zinc and sulphuric acid; the anode should be cleaned before each experiment by treatment with hot nitric acid, and water, heating to redness, washing with hot nitric acid, water, and alcohol, and drying in the air; the results are but slightly effected by changing the length of the anode wire from 2·5 mm. to 1 mm., or by platinising the anode, or covering it with a glass tube so as to reduce the volume of the anode compartment; shaking the anode has only a temporary effect, but the solution must not mix with the kathode solution; the measurements should be taken with rising e.m.f., as if taken in the opposite direction, the cell must be short-circuited between measurements and then at least ten minutes allowed for the galvanometer to attain a steady condition. The formation of aniline black from *n*/10 aniline in solutions of *n*-hydrochloric acid or *n*-sulphuric acid takes place at 0·95 volt, using a small anode and a hydrogen kathode. Hence, only traces of chloro-aniline are formed on electrolysing aniline in hydrochloric acid solution, but bromo-anilines are formed by the electrolysis of solutions containing hydrobromic acid and aniline. In this respect solutions of aniline resemble those of phenol. The oxidation potential of *m*-nitraniline in sulphuric acid solution is 1·48 volts, which is much higher than that of aniline. T. H. P.

281. *Deposition of Aluminium from Ethyl Bromide Solution.* **H. E. Patten.** (Journ. Phys. Chem. 8. pp. 548–565, Nov., 1904.)—The author confirms the values given by Plotnikoff for the conductivity of aluminium bromide dissolved in ethyl bromide, and also the deposition of crystalline aluminium from such a solution [see Abstract No. 158 (1903)]. Decomposition curves are given for dilute and concentrated solutions of aluminium bromide in ethyl bromide, with platinised and polished platinum electrodes and with aluminium electrodes. Aluminium has a single potential of + 1·10 (± 0·2) volts (neglecting the possible small e.m.f. at the contact of the solutions) against a 40·95 per cent. solution of aluminium bromide in ethyl bromide, and bromine a single potential of − 1·20 (± 0·02) volts. A current density of 0·0023 amp. per sq. cm. is just sufficient to compensate for the solvent action of the solution upon the deposited aluminium in the concentrated solution (40·95 per cent.); a dilute solution (4·38 per cent.) fails to yield aluminium even at moderately high current density. An aluminium anode, stripped of its film electrolytically, gives 2·235 volts in a 4·38 per cent. solution of aluminium bromide in ethyl bromide against a platinum kathode. With magnesium the value is 2·277 volts, from which, by subtracting + 1·20 for bromine, 1·08 volts is obtained as the approximate single potential of magnesium against this solution. A striking exception to the Nernst-Thomson rule is given by the observation that ethyl bromide, with a dielectric constant of 8·9, yields a solution of good conductivity in aluminium bromide solution. The author discusses the bearing of these results upon the aluminium anode phenomena; it appears that a film is formed upon aluminium in a solution very free from oxygen, but the high counter pressure observed for aqueous solutions has not yet been remarked. Aluminium bromide dissolved in ethyl bromide does not satisfy the requirements of a commercial plating solution for the deposition of aluminium. T. H. P.

282. *Electrolytic Oxidation of Potassium Ferrocyanide with Various Anodes.* **A. Brochet** and **J. Petit.** (Comptes Rendus, 139. pp. 855–857, Nov. 21, 1904.)—The experiments were made in kathode vessels of nickel, with a revolving anode in a porous cell, and currents of 5 amps., and lasted about one hour in each case. At the anode are formed ferricyanide and ferrohydrocyanic acid; the anion $(Fe(CN)_6)''''$ yields oxygen, lost for the oxidation, according to $Fe(CN)_6 + 2H_2O = Fe(CN)_6H_4 + O_2$, and further forms a ferrocyanide with the anode metal, if the metal is attackable; if this latter compound is insoluble, the potential difference rises. The anodes may be classed in five groups: Smooth Pt, yield of potassium ferricyanide 75 per cent., platinised Pt 45 per cent., graphite 33–6 per cent., final voltage about 5; Fe, Co, Ni, yields of 50 or 30 per cent., 5 volts; the other metals, Pb, Sn, Cu, Zn, Cd, Hg, Mg, Al, Ag, give poor yields, or the pressure rises above 30 volts. H. B.

283. *Theory of Amphoteric Electrolytes.* Part II. **J. Walker.** (Roy. Soc., Proc. 74. pp. 271–280, Dec. 10, 1904.)—This paper contains a correction of an error which occurred in the previous paper [see Abstract No. 1574 (1904)], and an extension of the theory therein developed. Useful examples and tables are given in order to facilitate the labour of calculating the dissociations in solutions of amphoteric electrolytes, and methods are explained whereby these data may be extended to a great variety of cases. The important theorem is established that if k_a be altered in any ratio and simultaneously k_b and v be altered in the inverse ratio, the relative proportion of undissociated electrolyte present will remain unaltered (k_a and k_b are the constants for the acidic and basic dissociations respectively, and v is the molecular dilution of total dissolved substance). This result is considered in connection with a discussion of the case of a series of amphoteric electrolytes for which the product k_ak_b is constant. Discrepancies between the values

for the molecular conductivity of asparagine calculated on the author's theory and those obtained experimentally by previous observers (Walden, Winkelblech) are shown to be due to the very small conductivity of asparagine, and the difficulty of freeing it from small quantities of more highly conducting impurities. It is pointed out that so long as no association of undissociated molecules takes place, the theory will apply not only to electrolytes of the type H . X . OH (such as the amino-acids), whose acidic and basic dissociations are represented by the equilibria—

$$\mathrm{H.X.OH} \rightleftharpoons \overset{+}{\mathrm{H}} + \mathrm{X.}\overset{-}{\mathrm{OH}}\ \text{(acidic)}$$

$$\mathrm{H.X.OH} \rightleftharpoons \overset{-}{\mathrm{OH}} + \overset{+}{\mathrm{HX}}\ \text{(basic)},$$

but also to amphoteric electrolytes of the type Y . OH (such as cacodylic acid, $(CH_3)_2AsO . OH$), which dissociate according to the equations—

$$\mathrm{YOH} \rightleftharpoons \overset{+}{\mathrm{H}} + \overset{-}{\mathrm{YO}}\ \text{(acidic)}$$

$$\mathrm{YOH} \rightleftharpoons \overset{-}{\mathrm{OH}} + \overset{+}{\mathrm{Y}}\ \text{(basic)}.$$

Experiments carried out in the author's laboratory by J. Johnston and published elsewhere (Ber. Deut. Chem. Gesell. 37. p. 3625, 1904) have verified this conclusion in the case of cacodylic acid. F. G. D.

REFERENCES.

284. *Specific Gravities of Lithium Chloride, Bromide, and Iodide.* **G. P. Baxter.** (Amer. Chem. Journ. 31. pp. 558–564, May, 1904.)—The results obtained by the author in determining the specific gravities of carefully purified lithium chloride, bromide, and iodide at 25°/4° are as follows: For the fused chloride, 2·068; fused bromide, 3·464; fused iodide, 4·061. Owing to a slight error in the calculations, the number given in the recent papers by Baxter and Hines [Amer. Chem. Journ., 31. p. 220, 1904] and Baxter and Lamb [Abstract No. 1582 (1904)] are erroneous. The corrected specific gravities are: Cadmium chloride, 4·047; cadmium bromide 5·192; silver bromide, 6·473. T. H. P.

285. *Recent Progress in the Manufacture of Sulphuric Acid.* **E. Sorel.** (Assoc. Franç. pour l'Avancement des Sciences, 6. pp. 76–86, June, 1904.)—A *résumé* of the various contact catalytic processes, details of which have appeared in the various journals, for the manufacture of sulphuric acid. T. S. P.

286. *Theory of Oxidisers.* **E. Abel.** (Zeitschr. Elektrochem. 10. pp. 721–725, Sept. 9, 1904.)—The author discusses the hypochlorites in the light of Nernst's theory of oxidising agents, and Abegg and Bodländer's theory of the anions of oxy-acids. T. H. P.

287. *Radio-active Cinnabarytes.* **S. M. Losanitsch.** (Chem. News, 90. pp. 217–218, Oct. 28, 1904. Ber. Deut. Chem. Gesell. 37. pp. 2904–2906, Sept. 24, 1904.)—The author finds that cinnabarytes (mercury ore containing barytes) from Avala and Bare in Servia and from Idria in Austria, is radio-active, though to a less degree than pitchblende. Since the barytes accompanying the mercury ore is inactive, it is supposed that radium is absent, and that the activity is due to a radio-active element allied to mercury—radio-mercury. This element is probably readily volatile, since roasted cinnabarytes exhibits no radio-activity. T. H. P.

288. *Molecular Volumes of Halogen Salts from the Atomic Volumes of their Constituents.* **M. Reinganum.** (Deutsch. Phys. Gesell., Verh. 6. 20. pp. 294–295, Oct. 30, 1904.)—The combination of elements is often accompanied by an extraordinarily large diminution of volume, which sometimes amounts to one half of the original volume. The volumes which must be taken for the separate elements in the compound are proportional to the square roots of their atomic volumes in the uncombined condition. For the halogen salts of the alkali metals, the molecular volume $= 0{\cdot}010$ (atomic volume of metal)$^2 + 0{\cdot}052$ (atomic volume of the solid halogen)^2. For the halogen salts of the alkaline earth metals, the latter term of this expression must be doubled, the two halogen atoms in these compounds occupying approximately equal volumes. T. H. P.

289. *Retrograde Diffusion of Electrolytes.* **E. Bose.** (Comptes Rendus, 139. pp. 727–728, Nov. 7, 1904.)—The author claims to have already, in conjunction with Abegg, predicted from the general osmotic theory of Nernst, the experimental results obtained by Thovert on this subject [see Abstracts Nos. 687 (1900) and No. 2120 (1902)]. W. H. Sı.

290. *Absorption of Hydrogen by Rhodium.* **L. Quennessen.** (Comptes Rendus, 139. pp. 795–796, Nov. 14, 1904. Chem. News, 90. pp. 271–272, Dec. 2, 1904.)—Contrary to Wilm the author finds that rhodium has no affinity for hydrogen, while its presence in the spongy condition condenses hydrogen and oxygen to form water, similarly to spongy platinum. He is, moreover, unable to detect any greater activity with rhodium obtained by decomposition of ammonium rhodium chloride, than with that from sodium rhodium chloride, when the latter has been washed free from sodium chloride. W. H. Sı.

291. *The Electric Furnace.* **A. Minet.** (Electro-Chemist, 4. pp. 88–100; Discussion, pp. 100–102, Dec., 1904.)—The origin, transformation, and applications of the electric furnace are detailed. A very complete classification of the types of furnaces is exhibited, and a long bibliography is appended. The latter is arranged with the names of inventors in alphabetical order. W. W. H. G.

292. *Copper and Oxygen.* **E. Heyn.** (Zeitschr. Anorg. Chem. 39. 1. pp. 1–23, March 15, 1904.)—Copper and cuprous oxide are mutually insoluble in the solid state, and separate completely when the alloy of copper and oxygen is allowed to solidify. The melting-point of pure copper is 1,103° C., that of the eutectic alloy with 3·4–3·5 per cent. of cuprous oxide is 1,084° C. T. M. L.

293. *Action of Alkyl Nitrites on Nickel Salts.* **C. Reichard.** (Chem. Zeit. 28. pp. 479–480, May 18, 1904.)—A method used for distinguishing between nickel and cobalt is their different behaviour towards potassium nitrite in acetic acid solution. But under certain conditions, nickel is also capable of yielding yellow crystalline double nitrites, *e.g.*, with the alkaline earth metals. On adding barium nitrate to a mixture of nickel nitrate and potassium nitrite, the double nitrite gradually falls out of solution, but if acetic acid is first added no precipitation takes place. Similar behaviour is exhibited by strontium nitrate. The calcium salt is considerably more soluble than that of barium or strontium. Magnesium, zinc, and cadmium yield no precipitates, but beryllium appears to form a nickel double nitrite. T. H. P.

294. *Pseudo-Acids.* **J. v. Zawidski.** (Ber. Deut. Chem. Gesell. 37. pp. 2298–2301, June 11, 1904.)—Starting from the law of mass action, the author shows that the apparent dissociation constant (k_e) of a pseudo-acid, calculated from the electrical conductivity, must be smaller than the real dissociation constant (k_1), unless isomerisation is complete. The constant k_1 has the value k_{H_2O}/k, where k is the constant of hydrolysis of the sodium salt. The isomerisation constant, k_2, of the pseudo-acid is calculated from the expression $k_e/(k_1 - k_e)$ for a number of such compounds. [See also Abstract No. 2408 (1904).] T. H. P.

295. *Velocity of Decomposition of a Mixture of Sodium Nitrite and Ammonium Chloride.* **E. Berger.** (Bull. Soc. Chim. 31. 3. pp. 662–666, June 5, 1904.)—Results are given of a quantitative study of the decomposition of an equimolecular mixture of sodium nitrite and ammonium chloride at various temperatures and concentrations, the amount of nitrogen evolved in a certain time being used as a measure of the rapidity of the reaction. The results, which are expressed both as curves and tables, show that these substances interact in all concentrations at temperatures above 0°, and that the velocity of the reaction increases rapidly with rise of temperature and decreases directly as the concentration diminishes, so long as this does not fall below 50 gm. per litre. When the dilution is greater than this the velocity diminishes more rapidly, as the salts become ionised to a considerable extent and hence escape the reaction. T. H. P.

296. *Chromates of Zinc and Cadmium.* **M. Gröger.** (Monatsh. f. Chemie, 25. 6. pp. 520–536, June, 1904.)—The action of K, Na, and NH_4 chromates on solutions of Zn and Cd salts have been examined. Some of the compounds produced are :—

$4ZnO, K_2O, 4CrO_3, 3H_2O.$
$4ZnO, CrO_3, 3H_2O.$
$2ZnO, (NH_4)_2O, 2CrO_3, H_2O.$
$4CdO, K_2O, 4CrO_3, 3H_2O.$
$4CuO, K_2O, 4CrO_3, 3H_2O.$

W. W. H. G.

297. *Bacteria which are able in Absence of Light to utilise Carbon Dioxide as Source of Carbon.* **M. W. Beyerinck.** (Centralblatt Bakt., Jena, 11. pp. 593–599, 1904.)—The author from his own experiments is able to confirm the results obtained by Natanssohn (Mitt. Zool. Stat. Neapel. 15. p. 655, 1903), showing that bacteria occur in the sea which reduce carbon dioxide by oxidation of hydrogen sulphide or thiosulphates. Sodium tetrathionate in presence of sodium carbonate was found to yield sodium sulphate, sulphur, and carbon dioxide. Sodium dithionate was not attacked. A bacterium, *Thiobacillus denitrificans*, was obtained from ditch water, which utilises free sulphur, converting carbonates and nitrates into sulphates with liberation of carbon dioxide and nitrogen. L. H. W.

298. *Reactions between Ammonium Salts and Metals.* **W. R. Hodgkinson** and **A. H. Coote.** (Chem. News, 90. p. 142, Sept. 16, 1904. Paper read before the British Association at Cambridge.)—Cadmium and, less readily, zinc and magnesium are dissolved by an aqueous solution of ammonium nitrate. In the cold no gas is evolved, but on heating to 100° nitrogen is set free. Apparently double nitrites are produced in the solution, the nitrogen being due to the decomposition of the ammonium nitrite. Melted ammonium nitrate also exercises a solvent action. The following metals are acted on in the order given: Cadmium, magnesium, zinc, copper, nickel, lead, bismuth. F. G. D.

299. *Breaks in the Solubility-Curves.* **W. Meyerhoffer.** (Journ. Phys. Chem. 8. pp. 571–575, Nov., 1904.)—This is a historical note in which is discussed the share taken by Gay-Lussac, Kopp, and Berzelius in the clear understanding and enunciation of the meaning of the break at 33° in the solubility-curve of sodium sulphate. It appears that although Gay-Lussac, in 1819, determined the break empirically, and subsequently (1839) came very near giving a correct interpretation of it, he never established the real relation between the break and the "melting-point" of Glauber's salt. It was Hermann Kopp who, in 1840, gave the first full and correct interpretation of all the observed facts, though Berzelius, in discussing Gay-Lussac's paper of 1839 in his Jahresberichte (1841), pointed out that the break at 33° was really due to the intersection of two different solubility-curves. As in many another case, several different minds converged slowly towards the truth. F. G. D.

300. *Hydro-Aromatic Substances. Nature of Double Linkings.* **A. W. Crossley.** (Chem. News, 90. pp. 168–170, Sept. 30, 1904. Paper read before the British Association at Cambridge.)—After describing recent work on hydro-aromatic substances, the author discusses the nature of double linkings. In the case of a substance containing several double bonds in the molecule, these bonds often do not behave independently of one another. Thiele's theory of partial valencies provides a possible explanation of many such cases. The theory of Knoevenagel, who considers it essential to study the movements of the atoms in the molecule and assumes that doubly linked carbon atoms are in a continuous state of oscillatory motion, is also discussed. T. H. P.

301. *Condition of the Hydrogen Sulphide in Mineral Springs.* **F. Auerbach.** (Zeitschr. Phys. Chem. 49. pp. 217–223, Aug. 9, 1904. Chem. Laborat. des Kaiserl. Gesundheitsamtes, Berlin, May 7, 1904.)—The dissociation constant of hydrogen sulphide at 18° is $0{\cdot}91 \times 10^{-7}$. From the avidity formula, the free and combined hydrogen sulphide and also the free and combined carbon dioxide in sulphur springs can be calculated. In mineral waters containing any considerable quantities of carbonic acid, the boric, silicic, and titanic acids are to be regarded as practically free and undissociated, while carbonates are virtually absent. T. H. P.

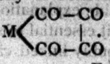
302. *Kinetics of Sugar-Inversion.* **J. W. Mellor** and **L. Bradshaw.** (Zeitschr. Phys. Chem. 48. pp. 353–358, June 7, 1904.)—Various hypotheses are made and their results worked out in order to explain the observed variation in the velocity-coefficient of the process of sugar-inversion by dilute acids. The authors do not appear to have arrived at any satisfactory theory. Special experiments show that the presence of the products of inversion produces very little effect on the value of the velocity-coefficient. F. G. D.

303. *Contribution to the Nernst-Planck Theory of the Potential-Differences between Dilute Solutions.* **K. R. Johnson.** (Ann. d. Physik, 14. 5. pp. 995–1003, Aug. 23, 1904.)—The paper deals with the mathematical theory of the p.d. between two solutions of different electrolytes. Let p and q denote the valencies of the positive and negative ion of one solution, m and n the corresponding valencies for the second solution. Planck worked out the particular case when $p=q=m=n$. The author now solves the further case where $p=m$, $q=n$. This is somewhat more general than Planck's case. F. G. D.

304. *Oxidation of Ferrous Salt Solutions.* **E. Jordis.** (Zeitschr. Elektrochem. 10. pp. 679–682, Aug. 26, 1904. Chem. Universitätslaborat., Erlangen.)—The author contributes a short notice of work published elsewhere dealing with slight changes in the composition of salts, and also with differences in their properties, according to the methods of preparation, and remarks also on the scantiness of experimental data in reference to a number of simple inorganic salts. A. F.

305. *Surface Effects in Beer and in the Preparation of Beer.* **F. Emslander** and **H. Freundlich.** (Zeitschr. Phys. Chem. 49. pp. 317–328, Aug. 30, 1904.)—The authors discuss a number of phenomena observed in the case of beer, such as persistence of froth and the "body" (Vollmündigkeit), absorption of carbon dioxide, heat of swelling of grain, &c., and show that they can be explained as due to surface effects due to the presence of substances in colloidal solution. A. F.

306. *Low Concentrations.* **F. Haber.** (Zeitschr. Elektrochem. 10. pp. 773–776, Sept. 30, 1904.)—The author discusses the bearings of the results of Abegg [see Abstract No. 3080 (1904)] and Bödlander on the work formerly published by him [see Abstract No. 2781 (1904)]. T. H. P.

307. *Constitution of Nickel Carbonyl.* **H. O. Jones.** (Chem. News, 90. pp. 144–145, Sept. 16, 1904. Paper read before the British Association at Cambridge.)—Nickel carbonyl reacts with hydroxylamine and hydrazine hydrate to give coloured compounds. These reactions point to its ketonic character. Nickel carbonyl also reacts with Grignard's reagent. In the case of phenyl magnesium iodide the product, when treated with acid, was found to consist chiefly of benzoin and diphenyl. The production of the former favours the formula  $M\left\langle\begin{array}{l}CO-CO\\ \quad\;\;\, |\\ CO-CO\end{array}\right.$. [See also Abstract No. 2770 (1904).] F. G. D.

308. *Studies on Racemisation.* **G. Bruni.** (Accad. Lincei, Atti, 13. pp. 373–381, Nov. 6, 1904.)—A miscellaneous paper giving (1) a short discussion of the author's work on racemisation in general; (2) a consideration of the effect of temperature on the phenomena; (3) a graphic representation of some of the results already obtained according to a scheme suggested by Meyerhoffer; the temperatures are plotted as ordinates against the combined dextro and racemo concentrations of the esters, as abscissæ; (4) some results obtained about two years ago by the author in conjunction with Padoa. Molecular weight determinations were made of tartaric ethyl ester in diphenyl methane and in naphthalene; also of racemic ethyl ester in the same solvents. The data show clearly the racemisation in the case of the racemic ester. With the ethylic ester of dibromo phenyl propionic racemate in presence of the dextrorotatory isomer, values for the molecular weight in naphthalene were obtained which indicated partial racemisation. [See also Abstracts Nos. 134 (1905).] D. H. J.

309. *Sulphocyanides of Palladium.* **I. Bellucci.** (Accad. Lincei, Atti, 13. pp. 386–393, Nov. 6, 1904.)—Very little has hitherto been known of the sulphocyanides of palladium, though they are worthy of study in order to see if in them palladium exhibits its well-marked tendency to form compounds of the bivalent rather than of the tetravalent type. Palladium sulphocyanide $Pd(SCN)_2$ and double salts $X_2Pd(SCN)_4$ (where X=potassium, silver, or barium) were prepared, but all attempts to obtain sulphocyanides of palladium of the tetravalent type failed. D. H. J.

310. *Complex Zirconium Salts.* **R. Ruer.** (Zeitschr. Anorg. Chem. 42. 1. pp. 87–99, Nov. 7, 1904. Inst. f. anorg. Chemie der Univ., Göttingen, Aug., 1904.)—From a study of the behaviour of solutions of (1) neutral zirconium sulphate, (2) $ZrOCl_2 + 2H_2SO_4$, and (3) $ZrOCl_2 + 2NaSO_4$, $(NH_4)_2SO_4$, the author concludes that the complexes $ZrOSO_4 . Na_2SO_4$ and $ZrOSO_4 . H_2SO_4$ exist, and that they dissociate thus: $ZrOSO_4 . Na_2SO_4 = 2Na^{\cdot\cdot} + ZrOSO_4 . SO_4{}^{\cdot\cdot}$. In the chloride and nitrate, however, the zirconium is a constituent of the kathion. T. H. P

311. *Action of Hydroperoxide on Tellurium.* **A. Gutbier** and **F. Resenscheck.** (Zeitschr. Anorg. Chem. 42. 2. pp. 174–176, Nov. 21, 1904. Chem. Laborat. der kgl. Univ., Erlangen, Sept. 1, 1904.)—Tellurium is dissolved in 30 per cent. KOH and then treated with three times the calculated amount of a 10 per cent. solution of H_2O_2. On filtering off (from a quantity of reduced tellurium), concentrating the filtrate and treating with excess of nitric acid, telluric acid crystallises out, having been produced from the potassium telluride by the oxidising action of the hydroperoxide. F. G. D.

312. *Condition of Colloidal Matter.* **G. E. Malfitano.** (Comptes Rendus, 139. pp. 920–922, Nov. 28, 1904.)—Discussion of the various theories regarding the structure of colloidal solutions. T. H. P.

313. *Iridium Sesquisulphate and its Alums.* **L. Marino.** (Zeitschr. Anorg. Chem. 42. 2. pp. 213–224, Nov. 21, 1904. Lab. di Chim. Farmaceutica del R. Istituto di Studi Superiori, Florence, Aug., 1904. Translation.)—The author describes the preparation of iridium sesquisulphate and its alums with Cs_2SO_4, Rb_2SO_4, K_2SO_4, $(NH_4)_2SO_4$ and Tl_2SO_4. In preparing the solution of $Ir_2(SO_4)_3$ from the tetrachloride, after reduction of the latter to trichloride by H_2S, the subsequent operations of precipitation of $Ir(OH)_3$ washing and solution in H_2SO_4, were carried out *in vacuo* in order to avoid oxidation. Iridium then, like rhodium, can form alums of typical composition. F. G. D.

314. *Hydration- and Hardening-Phenomena.* **P. Rohland.** (Zeitschr. Elektrochem. 10. pp. 893–900, Nov. 25, 1904.)—A discussion of mortar, plaster of Paris, Portland and Roman cement from a physico-chemical standpoint. The author considers that the hardening or setting is due to the formation of solid solutions. The action of various positive and negative catalysers is discussed. In many cases the author ascribes the action of the positive catalysers to an increase of solution-pressure of the solid with respect to the solution, though it cannot be said that his evidence for such a view is very convincing. The paper contains many very interesting details which cannot well be abstracted. [See also Abstract No. 3318 (1904).] F. G. D.

315. *Electrolytic Preparation of Potassium Cyanate.* **E. Paternò** and **E. Pannain.** (Gazzetta Chim. Ital. 34. 2. pp. 152–153, Aug., 1904.)—The most favourable conditions for the electrolytic oxidation of potassium cyanide to cyanate are: (1) The concentration of the cyanide to be from 4 to 6 gm.-mols. per litre. (2) The presence of 1 gm.-mol. of potassium hydroxide per litre. (3) An e.m.f. of 4 to 6 volts. (4) An anodic current density of from 1 to 4 amps. per sq. dm. (5) The electrolyte to be mixed by agitating the anode. Under these conditions, and if the electrolysis is sufficiently prolonged, almost the whole of the cyanide is converted into cyanate, part of which crystallises out during the electrolysis. T. H. P.

316. *Electrolytic Determination of the Basicity of Acids.* **I. J. Moltkehansen.** (Amer. Elektrochem. Soc., Trans. 4. pp. 39–45, 1903.)—Measurements of the electrical conductivity of solutions of the ammonium phosphate prepared by the action of ammonium sulphide on precipitated copper (meta) phosphate showed it to be the dimetaphosphate. T. M. L.

317. *Dissolution of Metals.* II. **T. Ericson-Aurén** and **W. Palmaer.** (Zeitschr. Phys. Chem. 45. pp. 182–198, Sept. 22, 1903. Elektrochem. Laborat. d. techn. Hochschule, Stockholm.)—Further experiments on the dissolution of zinc in sulphuric acid of different concentrations have confirmed the earlier observations [Abstract No. 901 (1902)] which indicated that local currents are the determining factor in the dissolution of metals. The influence of depolarisers and of metals alloyed with the zinc is also discussed. T. M. L.

318. *Rôle of Cohesion Pressure, of Doppler's and Weber's Principles in the Theory of Electrolysis.* **R. Mewes.** (Elektrochem. Zeitschr. 10. pp. 137–140, Sept., and pp. 159–166, Oct., 1903.)—In this paper, which is not suitable for abstraction, the author puts forward a theory of electrolysis founded on cohesion pressure, and on the Doppler and Weber effects. The electrolytic dissociation theory is considered to be false. The paper contains a table of the cohesion pressures of mercury over a range of temperature from 9° C. to 360° C. T. S. P.

319. *Anodic Behaviour of Copper and Aluminium.* **F. Fischer.** (Zeitschr. Phys. Chem. 48. pp. 177–219, May 27, 1904.)—This paper gives in greater detail an account of work already published. [See Abstract No. 1564 (1904).] T. H. P.

320. *Electrolytic Production of Perchlorates.* **W. Oechsli.** (Zeitschr. Elektrochem. 9. pp. 807–828, Oct. 8, 1903. From the Elektrochem. Lab. der K. techn. Hochschule, Dresden.)—As the result of a long series of experiments it is concluded that the electrolytic production of perchlorates depends on the spontaneous decomposition of charged chlorate ions in the sense of the equation $2Cl\overline{O}_3 = Cl\overline{O}_4 + Cl\overline{O}_2$, the chlorite ions being then oxidised by the current to chlorate. It is considered that direct oxidation of chlorate to perchlorate does not occur. T. M. L.

321. *Electrolysis of Copper Sulphate Solutions.* **F. Foerster** and **G. Coffetti.** (Zeitschr. Elektrochem. 10. pp. 736–741, Sept. 16, 1904. Elektrochem. Laborat. d. techn. Hochschule, Dresden.)—A discussion based on experimental observations to show that a consideration of the equilibrium of $Cu + Cu^{\cdot\cdot} \rightleftarrows 2Cu^{\cdot}$ and the related conditions of potential gives the whole electrochemical behaviour of a copper sulphate solution with a kathode and copper anode. [See Abstracts Nos. 1519 (1903) and 430 (1904).] F. S.

322. *Electrolysis of Alkali Chlorides in the Presence of Fluorine Compounds.* **F. Foerster** and **E. Müller.** (Zeitschr. Elektrochem. 10. pp. 781–783, Sept. 30, 1904. Elektrochem. Laborat. d. techn. Hochschule, Dresden.)—Siemens and Halske recently patented a process for the electrolytic preparation of halogen acid salts in the presence of fluorine compounds. The authors show that under the conditions of this process, if the concentration of the hypochlorite diminishes, the hydrofluoric acid ions have no influence. The process works owing to the use of a warm acid solution. F. S.

323. *Carbon Elements.* **D. Tommasi.** (Centralblatt Accumulatoren, 5. pp. 193–194, Sept. 1, 1904.)—Refers to two types of carbon cells giving an e.m.f. of 0·6 to 0·7 volt. It is calculated that with carbon and lead peroxide cells the value should be 0·84 volt. The action of concentrated solution of NaCl in such cells is discussed. W. W. H. G.

324. *Mercury Kathode in Electrochemical Analysis.* **R. E. Myers.** (Amer. Chem. Soc., Journ. 26. pp. 1124–1135, 1904.)—A long paper dealing with the advantages of the use of a mercury kathode in electrolytic separation. By its means even chromium can be quantitatively separated from aluminium. L. H. W.

325. *Electrolysis of Potassium Acetate.* **H. Hofer** and **M. Moest.** (Zeitschr. Elektrochem. 10. pp. 833–834, Oct. 21, 1904.)—The authors point out that if Foerster and Piguet had made a closer examination of the solutions after electrolysis [see Abstract No. 3329 (1904)] they would have detected the presence of methyl alcohol. As the formation of methyl alcohol is accompanied by the liberation of hydrogen and carbon dioxide, the latter need not always be an oxidation product. [See Liebig's Ann. 323. p. 304, 1902.] F. S.

326. *Passivity and Solutions of Metals at the Anode.* **O. Sackur.** (Zeitschr. Elektrochem. 10. pp. 841–844, Oct. 28, 1904.)—After reviewing some of the work of others in this direction and discussing the phenomena of electrolysis with different anodes, the author concludes that the property of metals to become passive is inversely related to their catalytic influence on the combination of hydrogen and oxygen. F. S.

327. *Electrolysis by Alternating Currents.* **A. Brochet** and **J. Petit.** (Annal. Chim. Phys. 3. pp. 433–499, Dec., 1904.)—Full account of the authors' researches on the electrolysis of the cyanides of Cu, Zn, Ni, Co, Fe, Pt, Cd, Ag, Hg, &c., on the influence of the frequency, and on the preparation of baryum platinocyanide [see Abstracts Nos. 1234, 1572, 1844, 2382, 2788 (1904)]. H. B.